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PHYSICS ABSTRACTS

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SECTION A OF SCIENCE ABSTRACTS *(Section B: Electrical Engineering)*

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Physics Abstracts

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PHYSICS ABSTRACTS

Volume 60 JANUARY 1957 Number 709

MATHEMATICS 51

517.9 : 536.2.01

1. AN OPTIMUM IMPLICIT RECURRENCE FORMULA FOR THE HEAT CONDUCTION EQUATION. S.H.Crandall.
Quart. appl. Math., Vol. 13, No. 3, 318-20 (Oct., 1955).

A formula, depending upon two parameters, is applicable to the numerical integration of the familiar differential equation of thermal conduction, by means of a network of finite differences. This formula is examined with respect to the stability of the solutions obtained and the order of magnitude of the error involved. It is found that, using a particular pair of numerical values for the parameters, the error can be appreciably reduced. R.Eisenschitz

518.5 : 537.533.3 : 621.317.729

2. AN AUTOMATIC ELECTRON TRAJECTORY TRACER. H.I.Pizer, J.G.Yates and K.F.Sander.
J. Electronics, Vol. 2, No. 1, 65-86 (July, 1956).

An apparatus is described which will automatically trace electron paths in electrostatic fields. Information about the field is obtained by measurement in an electrolytic tank, and the equations of motion are integrated by a special purpose digital computer. The results of the computation are fed back to the electrolytic tank so that the measuring probes automatically trace the desired trajectory. A.

518.5 : 681.142 : 621.374.32

3. THE DESIGN OF A LOGIC FOR THE RECOGNITION OF PRINTED CHARACTERS BY SIMULATION. E.C.Greanias, C.J.Hoppel, M.Kloomok and J.S.Osborne.
Proc. Instn Elect. Engrs, Paper 2149 M (Part B Suppl. No. 3, 456-62, 473-5).

A logic for the recognition of printed characters employing a proportional-parts method has been tested extensively by simulation; the method relates the identity of a character to the relative size and position of character elements detected by optical scanning along closely spaced vertical lines, the video information from each scan being coded to designate the number, size and position of inked areas detected by the scanner. The time sequence or order of occurrence of this coded information is tested by logical circuits against prescribed sequences for character recognition. A set of coding definitions, a prescribed sequence for the recognition of a given character, and the methods of similative testing of the recognition logic on a magnetic-drum data-processing machine are discussed. A.

518.5 : 519.24 : 621.373.43 : 681,142 : 621.317.79

4. ANALOGUE COMPUTER GENERATION OF PROBABILITY DISTRIBUTIONS FOR OPERATIONS RESEARCH. N.D.Diamantides.
Trans Amer. Inst. Elect. Engrs I, Vol. 75, 86-91 (1956) = Commun. and Electronics, No. 23 (March, 1956).

Generating circuits for producing random pulse trains are described. They include Gaussian distribution of pulse duration, pulse rate and pulse amplitude. Circuits for transforming the pulse output to give other distributions such as uniform probability are also described. J.M.C.Dukes

518.5 : 539.11

5. A DIGITAL COMPUTER PROGRAM FOR DETERMINING ATOMIC-WAVE FUNCTIONS. W.W.Piper.
Trans Amer. Inst. Elect. Engrs I, Vol. 75, 152-5 (1956) = Commun. and Electronics, No. 24 (May, 1956).

A theoretical interpretation of phosphor phenomena in terms of solid state physics. The programming of the method of solution of a set of non-homogeneous, second-order differential equations, having coefficients which are functions of the solutions, for computing H—F (Hartree—Fock) self-consistent field-wavefunctions, is described. The H—F equations may be used to obtain a close approximation to the solution of the Schrödinger equation for systems consisting of two or more electrons but the computation is reduced from months to hours by the use of an I.B.M. 650 magnetic drum digital computer. J.MacCormack

518.6

6. THE THEORY OF APPROXIMATION. V.Doležal and L.Kosmák.
Slaboproudý Obzor, Vol. 17, No. 6, 325-30 (1956). In Czech.

The uniform approximation is defined and its properties are stated in a number of theorems (without proofs). It is shown that the functions of the class C(a, b), which are continious and single-valued within a closed interval from a to b, can be approximated in a uniform manner either by the Bernshtein algebraic polynomials or by the De la Vallée Poussin trigonometric polynomials. The problem of optimum uniform approximation is shown to lead, for some function of the class C(a, b), to the Chebȳshev polynomials. The quadratic approximation is considered in terms of the n-dimensional geometry, the approximated functions being of the class L^2. Here the approximation is carried out by orthogonal systems such as: trigonometric functions, Legendre, Chebȳshev, Laguerre and Hermite polynomials and Bessel functions. R.S.Sidorowicz

519.281.2

7. REMARKS ON THE LEAST-SQUARES REDUCTION OF ANGULAR CORRELATION DATA. E.Breitenberger.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 489-91 (June, 1956).

A discussion of the determination by the method of least squares of the constants c_2 and c_4 in the expression $K(\delta) = A\{1 + c_2 P_2(\cos\delta) + c_4 P_4(\cos\delta)\}$ for the coincidence rate $K(\delta)$ between radiations emitted from a radioactive source at an angle δ. Since the expression for $K(\delta)$ is not linear in the constants A, c_2 and c_4, it is linearized by choosing trial values of these constants and forming normal equations for the corrections to the trial values. A.H.Cook

ASTRONOMY . ASTROPHYSICS . GEODESY 52

522.2 : 522.615

8. A SIMPLE PHOTOELECTRIC AUTO-FOLLOWER FOR ASTRONOMICAL TELESCOPES. H.H.Rabben.
Elektron. Rdsch., Vol. 10, No. 7, 189-90 (July, 1956). In German.

The main telescope has an objective 100/1650 mm, and its application is solar photography. The follower is attached to the auxiliary telescope. The required accuracy is 2-3 sec of arc. An image of the sun is projected on to a circular (disk) diaphragm 20 mm diameter which is surrounded by a ring diaphragm to form an annular gap 0.1 mm in radial width. When the image is exactly coaxial with the diaphragms, its diameter is such that a ring of light of uniform brightness, and half the gap width, is formed below them. Four prisms, disposed at 90°, reflect light, which has passed through the ring gap, radially outwards on to four photocells. Diametrically opposite photocells are connected with two resistors to form a bridge, and the two bridges are connected to the input circuits of separate d.c. amplifiers. The amplifiers are of the "carrier" type, the carrier frequency being 12 kc/s, and they operate relays which control the two telescope driving motors. When the ring of light is of uniform brightness, the two bridges are balanced; movement of the solar image unbalances the bridge, or bridges, and an appropriate mechanical correction is applied. The telescope has the customary equatorial mounting and clock drive; the function of the photoelectric control for this motion is merely corrective. C.F.Pizzey

522.6 : 522.2 : 523.164

9. THE CAMBRIDGE RADIO TELESCOPE. M.Ryle and A.Hewish.
Mem. Roy. Astron. Soc., Vol. 67, Pt 3, 97-105 (1955).

The instrument designed to make accurate observations on a considerably larger number of radio stars than in previous surveys, makes use of four aerials situated at the corners of a rectangle and the resulting interference patterns in the north-south and east-west planes enable the coordinates of radio stars to be determined with great precision. In addition, the system may be arranged to detect sources of large angular diameter and to investigate the general background radiation. A.

523

10. VISTAS IN ASTRONOMY. Edited by A.Beer.
London/New York/Paris: Pergamon Press (1955-56). Volume I, xvi + 1-776 and Volume II, 777-1000 pp. [Supplement to Journal of Atmospheric and Terrestrial Physics].

A comprehensive survey of contemporary astronomy and its allied sciences, comprising 192 papers by over 200 authors. Abstracts of some of these will appear under their appropriate subject headings.

523.035.338.334 : 535.338.334

11. PROBLEMS OF STARK BROADENING FOR EXPERIMENTAL AND ASTRONOMICAL SPECTRA LIABLE TO SELF-ABSORPTION. M.Johnson.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 1, 15-22 (1955).

Experiments are described, relevant to the problem of correlating quantitatively a Stark effect, or any alternative explanation of broadening in spectral lines, with physical state of an atmosphere. A particular difficulty is that of fitting any theoretical contour to an observed line when an unknown degree of self-absorption is suspected of distorting the broadened structure, as in solar flares or radiation from unknown depth in the expanded atmospheres of early-type stars. To study a Stark contour in the presence of self-absorption the laboratory source chosen is a deep electrodeless plasma with unusually high charge density at low voltage. Contours of Hα are analysed by transmitting from a high-dispersion spectrometer into a photomultiplier through a slit of aperture small compared with line-width. The assumptions required in fitting theories of broadening to contours are examined, to find conditions which a degree of self-absorption in the core of the line nated. Misfit in the extreme wings is related to which have arisen in stellar physics. A.

523.11

12. THE POSSIBILITY OF TURBULENCE IN THE PRIMARY PLANETARY CLOUD. V.S.Safronov and E.L.Ruskol.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 413-16 (1956). In Russian.

Criteria of stability of streamline flow between two cylinders are applied to the flow of the initial cloud about the sun. According to this test streamline flow should be stable. Assuming that the change of temperature in the cloud complies with the adiabatic law, the possibility of heat flow by convection is investigated. It is found that convection cannot arise. The authors conclude that the flow in the initial cloud was not turbulent. R.Eisenschitz

523.11 : 523.855

13. ON THE FORMATION OF GALAXIES IN A STEADY STATE UNIVERSE. D.W.Sciama.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 1, 3-14 (1955).

Proposes a mechanism which depends on the feature of the steady-state universe, that any particular galaxy is formed in a universe already full of galaxies. The gravitational fields of these pre-existing galaxies produce density concentrations in the intergalactic gas so that new galaxies can form as a result of gravitational instability. The condition that the properties of this system of galaxies be independent of time suffices to determine these properties uniquely, i.e. without any adjustable parameters. This theoretical distribution is in reasonable agreement with observation for the average mass, size, separation, peculiar velocity and clustering tendencies of galaxies. These results suggest that the steady-state theory may enable one to account for the actual distribution of matter in the universe entirely in terms of the general laws and constants of nature. A.

523.11 : 530.12

14. THE INSTABILITY OF THE EINSTEIN UNIVERSE. W.B.Bonnor.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 3, 310-22 (1955).

The stability of the Einstein universe is investigated using the new boundary conditions at surfaces of discontinuity, discovered by O'Brien and Synge. On certain assumptions it is shown that the Einstein model may represent a universe with inhomogeneities, but that, in general, these must be static, otherwise the model is unstable. In the case of an instantaneous disturbance in the Einstein universe, the processes which cause instability must involve discontinuities in the pressure or its time derivatives. If the matter present satisfies an equation of state, no physically plausible disturbance of the static condition is possible, and the model is stable. If there is no equation of state, small disturbances involving changes in the pressure or its derivatives can occur, and will, in general, lead to instability, though in certain special cases condensations may begin to form without initial instability. A.

523.11

15. SPECULATIONS ON COSMOGONY. M.Goldhaber.
Science, Vol. 124, 218-19 (Aug. 3, 1956).

An attempt is made to introduce particle—antiparticle concepts. It is assumed that a self-conjugate particle containing the mass of the whole universe is divided into a "cosmon" and an "anticosmon", the "cosmon" corresponding to Lemaître's primeval atom. R.A.Newing

523.11 : 534.222.2

GRAVITATING GAS HYPOTHESIS OF STAR FORMATION.
See Abstr. 179

523.162

16. THE LAW OF INTERSTELLAR REDDENING AND ABSORPTION. W.A.Hiltner and H.L.Johnson.
Astrophys. J., Vol. 124, No. 2, 367-78 (Sept., 1956).

The law of interstellar reddening and the slope of the reddening lines in the plot of U−B v. B−V have been reinvestigated in the light of more extensive data. The data consist of a catalogue of 262 O stars for which three-colour photometric and slit spectrograms are available. The anomalous behaviour of stars in the Great Rift in Cygnus found by Johnson

and Morgan is confirmed. The equation of the mean reddening line is $E_{U-B}/E_{B-V} = 0.72 + 0.05E_{B-V}$. A rediscussion of the ratio of total to selective absorption, with additional new data, gives $R = A_V/E_{B-V} = 3.0 \pm 0.2$ (p.e.). A.

523.162.1

17. POLARIZATION OF STARLIGHT IN THE REGION OF THE PLEIADES. S.van den Bergh.
Z. Astrophys., Vol. 40, No. 4, 249-77 (1956). In German.

Using a calcite crystal, photographic polarization measurements were made of 217 stars in the Pleiades. No difference was found between the polarization in the red and in the blue. To a first approximation the frequency distribution of the directions of polarization (maximum of the electric vector) in the investigated region can be considered to be Gaussian, with a maximum deviating from the direction parallel to the galactic equator. This deviation, and the difference between filament direction and the direction of polarization, which Hall found for a few stars in the Pleiades, is due to a partly invisible nebula just in front of the Pleiades. Deviations from the Gaussian distribution are found to be correlated with the filamentary structure of the Pleiades nebulae. The polarization shows a definite increase at a distance roughly equal to the distance of the Pleiades cluster. Using observations by Hall, Mikesell and Hiltner in a region containing the double cluster in Perseus, a reinvestigation is made of the ratio of polarization to colour excess. Depolarization effects may be neglected in this region. The large scatter in the relation between polarization and colour excess is partly due to systematic differences between the intrinsic colours of supergiant and main sequence stars. Polarization and the colour indices U–B and B–V were used to determine the intrinsic colours of class II, III, IV and V stars and of supergiant stars. A real scatter in the intrinsic colours of the supergiants is found. Using only stars of class II, III, IV and V and excluding emission line stars, a linear relation was found between polarization and colour excess. A.

523.164 : 621.396.99

18. RADIO ASTRONOMY AND THE JODRELL BANK TELESCOPE. A.C.B.Lovell.
Proc. Instn Elect.Engrs, Paper 2227, publ. Nov., 1956 (Vol. 103 B, 711-21).

Describes some of the scientific characteristics of the 250 ft-aperture steerable radio telescope at the Jodrell Bank Experimental Station of the University of Manchester. Some of the research problems on which the telescope will be used are then outlined against the current background in radio astronomy. These include the study of the background continuum radio emission of the Galaxy and of the galactic radio sources over a wide range of wavelengths. The main programme on the extragalactic radio emission will involve a study of the spatial distribution of particular classes of extragalactic radio sources and the measurement of their distances, from which it is hoped that significant progress can be made with cosmological problems. The telescope will also be used as a combined transmitter and receiver to make further studies of the moon and possibly the planets. Other items in the programme include the study of very faint meteors by the radio echo technique and various problems of solar terrestrial relationships of particular importance to the International Geophysical Year. A.

523.164

19. THE INTERFEROMETRIC STUDY OF BRIGHTNESS DISTRIBUTION IN RADIOASTRONOMY. II. THE APPROXIMATIONS REACHED IN RECEPTION BY A DIRECTIVE AERIAL. J.Arsac.
Rev. Opt., Vol. 35, No. 3, 136-65 (March, 1956). In French.

A continuation of the analysis of the relation between the received signal and the brightness distribution of the source, expressed in spatial harmonics (see Pt I, Abstr. 5615/1956). Special attention is paid to the influence of the theoretical considerations on the design of actual aerial systems, and numerical examples of complete and incomplete arrays with up to 13 components are given. M.W.Ovenden

523.164.3 : 523.77

20. PRODUCTION OF THE SUN'S NON-THERMAL RADIO EMISSION BY ČERENKOV RADIATION. L.Marshall.
Astrophys. J., Vol. 124, No. 2, 469-75 (Sept., 1956).

It is proposed that practically all the non-thermal radio emission from the sun, namely, that part correlated with sunspots, can be accounted for as Cherenkov radiation emitted when jets of electrons travel up out of sunspots through regions of progressively lower magnetic field (which determines the cyclotron frequency) and decreasing electron density (which determines the plasma frequency). The behaviour of the index of refraction as a function of cyclotron and plasma frequencies, as it regulates the frequency of Cherenkov radiation, is used to explain the main features of the radio spectra, including the sharp cutoff on the low-frequency side. The experimental fact of simultaneous radio emissions at two or more discrete frequencies is well accounted for, but the hypothesis of Cherenkov radiation does not seem to provide a satisfactory explanation of the recently observed exact frequency doubling. The magnitude of the intensity is correctly given. A.

523.164.42

21. A SURVEY OF RADIO SOURCES BETWEEN DECLINATIONS -38° AND $+83^\circ$. J.R.Shakeshaft, M.Ryle, J.E.Baldwin, B.Elsmore and J.H.Thomson.
Mem. Roy. Astron. Soc., Vol. 67, Pt 3, 106-54 (1955).

Observations at a wave-length of 3.7 m with the Cambridge radio telescope have enabled 1936 radio sources to be located between declinations -38° and $+83^\circ$. By the use of interferometric methods to derive both coordinates it has been possible to determine the positions of 500 of the most intense sources with an accuracy of about $\pm 2'$ of arc in right ascension and $\pm 12'$ of arc in declination. The majority of the sources were found to be of small angular diameter, and these were distributed isotropically except for a cluster of six intense ones near the anticentre. An examination of the number–intensity relationship shows that it cannot be interpreted in terms of a homogeneous distribution of sources. Some 30 of the sources were of large angular diameter (20'-180' of arc); the more intense of these were close to the galactic equator and must represent a rare class of galactic object. The positions of all the sources have been compared with those of a number of classes of optical objects; about 100 appear to be related to objects in the NGC and Index Catalogues, and an intense source has been found close to the position of Kepler's Nova, 1604. A.

523.164.42

22. POLARIZATION MEASUREMENTS ON THREE INTENSE RADIO SOURCES. R.H.Brown and H.P.Palmer and A.R.Thompson.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 5, 487-92 (1955).

The radiation from three intense extra-terrestrial radio sources, in Cygnus, Cassiopeia and Taurus, has been tested for polarization at a wavelength of 1.9 m. The results show that, in the flux from the sources in Cygnus and Cassiopeia, there is no plane polarized component greater than 1 per cent and no circularly polarized component greater than 4 per cent. In the case of the source in Taurus (the Crab Nebula) the corresponding limits are $2\frac{1}{2}$ per cent and 4 per cent respectively. A.

523.165

23. SOLUTION OF THE FUNDAMENTAL DIFFUSION EQUATION FOR COSMIC RAY PARTICLES EMITTED BY A CONSTANT ENERGY CONCENTRATED PULSED SOURCE. Yu.A.Popov.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 80-5 (1956). In Russian.

The fundamental diffusion equation deduced by Terletskiĭ for cosmic ray protons emitted in magnetized interstellar space during a short period of time by a concentrated source of given energy has been solved. It is shown that if particles which remain after collision of cosmic ray protons with protons of the interstellar gas are taken into account and if the source is assumed to be a supernova which appeared in the centre of the galaxy over 10^8 years ago a power law spectrum is obtained which is similar to that observed experimentally. A.

523.2 : 538.12

24. THE MAGNETIC FIELD IN THE VICINITY OF THE SOLAR SYSTEM. W.L.Kraushaar.
Progr. theor. Phys., Vol. 14, No. 1, 77 (July, 1955).

From a consideration of the behaviour of low energy cosmic-ray particles of solar origin, a limit of 10^{-5} gauss has been put on the possible uniform magnetic field which has been suspected to lie along the galactic spiral arms. Cosmic-ray intensity increases associated with solar flares appear to be

due to particles having a momentum of 1-10 BeV/c and approaching the earth from a region up to 60° in longitude and 30° in latitude. The galactic field must not be so large as to deflect these particles out of this region. D.J.A.Prowse

523.21

25. THE OXFORD 35m SOLAR TELESCOPE. H.H.Plaskett.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 5, 542-9 (1955).

A new telescope for solar work with an equivalent focal length of 35.2 m is described. It is an ordinary Cassegrain reflector used at the coudé focus. The optical requirements for satisfactory performance are listed and some of the mechanical features briefly described. The performance is assessed from a Hartmann test. A.

523.43

26. PHYSICAL CONDITIONS ON MARS. A.I.Lebedinskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 795-8 (1956). In Russian.

A discussion of the atmospheric conditions on Mars in terms of the infrared carbon dioxide absorption spectra. J.M.Hough

523.53

27. INADEQUACY OF RECOMBINATION AS THE SOURCE OF LIGHT FROM ENDURING METEOR TRAINS. G.S.Hawkins and A.F.Cook.
Nature (London), Vol. 178, 161-2 (July 21, 1956).

It is shown that the visual intensity of meteor trains is some 200 times greater than that to be expected from the radiative recombination of meteoric ions and free electrons. M.W.Ovenden

523.71

28. GREENWICH OBSERVATIONS OF THE HORIZONTAL AND VERTICAL DIAMETERS OF THE SUN. P.J.D.Gething.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 5, 558-70 (1955).

It has been claimed that the Greenwich observations of the horizontal diameter of the sun are in agreement with those made at Campidoglio and Monte Mario in indicating a real variation of diameter with a period of about 22 years. It is shown in the present paper that this conclusion cannot be justified from the data considered. A more detailed analysis of the Greenwich measurements of both the horizontal and vertical diameters in the period 1915 to 1936 is given, in which corrections are applied for irradiation and personality differences between observers. The resulting diameters show comparatively large variations from year to year. These variations do not necessarily represent real changes in the size of the sun; they may be due to variations in the mean personality correction. No definite relationship can be established between the apparent variations in diameters and other phenomena, such as the sunspot cycle. A.

523.72 : 523.78

29. MEASUREMENTS OF SOLAR RADIATION AT 20 cm AND 3 cm WAVELENGTHS, AT THE TIME OF THE SOLAR ECLIPSE OF 30TH JUNE, 1954. O.Hachenberg, F.Fürstenberg and H.Prinzler.
Z. Astrophys., Vol. 39, No. 4, 232-47 (1956). In German.

The variation of intensity of 20 cm radiation during the eclipse was measured at two stations, using paraboloidal aerials of 8 m and 4 m respectively. The variation of 3.2 cm intensity was measured at one station only, using a technique similar to that of Dicke (Abstr. 2539/1946). The observations could be interpreted in terms of an elliptical sun; for λ = 20 cm, the radius in the direction of the solar equator was 1.2 R (R = solar radius) and in the direction of the poles 0.9 R. For 3.2 cm, the equatorial radius was 1.04 R. The brightness distribution across the solar disk could be estimated for the 20 cm radiation; in the equatorial direction there was a bright rim at 1.1 ± 0.03 R with an intensity of 2.5 ± 0.3 times the central intensity, while in the polar direction the intensity fell monotonically from 0.7 R. M.W.Ovenden

523.72 : 537.591.5

COSMIC-RAYS AND CORPUSCLES FROM THE SUN. See Abstr. 521.

523.745 : 537.591.5

COSMIC-RAY OBSERVATIONS DURING THE FLARE OF 23 FEBRUARY 1956. See Abstr. 513.

523.745-77

30. RAPID SEQUENTIAL PHOTOGRAPHY OF THE SOLAR PHOTOSPHERE AND SPOTS. J.Rösch.
C.R. Acad. Sci. (Paris), Vol. 243, No. 5, 478-80 (July 30, 1956). In French.

Some results obtained from a new technique, in which sequential exposures of between 1/160 and 1/360 sec are made at the rate of 20 sec^{-1}, are described. Effects of the varying refraction of air-masses near the camera objective are clearly shown; and also the dependence of the visual photospheric pattern on the size of the solar granules is demonstrated. The existence of bright granules within the sunspot zones, and of dimensions smaller than those of the photospheric granules (Thiessen, 1950), is confirmed. D.R.Barber

523.746 : 523.76

31. ON AZIMUTHAL SOLAR MAGNETIC FIELDS. V.C.A.Ferraro and P.C.Kendall.
Astrophys. J., Vol. 124, No. 2, 443-7 (Sept., 1956).

The theory of sunspot magnetic fields recently developed by Bullard (1956) and more briefly by Cowling (1946) is reviewed. It is shown that if the sunspot field is generated by convection to the surface of a subsolar azimuthal field, the magneto-mechanical forces arising from a field large enough to give rise to an observed sunspot field are considerable. They cannot be balanced by other forces or pressure gradients, and they would inevitably produce large-scale meridional motion in the sun far exceeding the observed "motion" of sunspots in latitude. This consideration seems to lead one to suppose that an azimuthal field in the subsurface layers is more likely to be produced by hydromagnetic waves. A.

523.746

32. THE LARGE SUNSPOT GROUP OF JUNE 1955. K.Lodén.
Ark. Astron., Vol. 2, Paper 4, 38 pp. (1956).

Details are given of the first large sunspot group which has occurred during the present increase of solar activity. The following events are discussed: flares, surges, coronal activity, geomagnetic disturbances, solar radio noise observations, radio fadeouts, ionospheric storms, and cosmic-ray intensity. G.M.Brown

523.746

33. NOTE ON THE OBSERVED DIFFERENCES IN SPOTTEDNESS OF THE SUN'S NORTHERN AND SOUTHERN HEMISPHERES. H.W.Newton and A.S.Milsom.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 4, 398-40 (1955).

The variation with time of the relative spottedness of the sun's two hemispheres, north and south, is examined by means of a simple index over a period embracing eleven 11-year sunspot cycles. There are changes from cycle to cycle which, although not random, appear to have no definite period. There is the suggestion of a dependence of the pattern of the excess spottedness, north and south, upon the degree of activity of any particular cycle. The results indicate no dependence upon a 22-year cycle. A.

523.75

34. ON THE POSSIBLE EXISTENCE OF LOW-TEMPERATURE PROMINENCES. Y.Öhman.
Ark. Astron., Vol. 2, Paper 1, 1-7 (1955).

A mechanism that may explain certain dark solar streamers is suggested in which the absorption effects are due to H^- ions, produced from H_2 molecules ejected from the solar surface. It is shown also that low-temperature prominences may evolve by the heating of cool gas clouds (e.g. H_2 molecules) which, unlike neutral H prominences, are able to survive exposure to short-wave radiation from nearby flares, with time factors of $\geq 100 : 1$. (see also Abstr. 1406, 4878/1952). D.R.Barber

523.75

35. ACCURACY OF SOLAR-FLARE OBSERVATIONS. L.W.Ross.
J. atmos. terrest. Phys., Vol. 7, No. 6, 344-5 (Dec., 1955).

A statistical investigation of the consistency among observations by different observers of the importance (on the scale 1, 2, 3) of the same flare shows that classes 1 and 3 are fairly reliable, but only 63% of observers correctly reported class 2. It is concluded that any finer division of classes is not at present justifiable. G.M.Brown

523.755

36. POLARIZATION OF THE SOLAR CORONA DURING THE TOTAL ECLIPSE OF JUNE 30, 1954. A.G.Pacholczyk.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 3, No. 11, 593-6 (1955).

The degree of polarization was measured photographically, using a polaroid filter, along the polar axis out to 1.4 solar radii, and along the equatorial axis to 3.0 solar radii. The polarization was found greater along the equatorial axis than along the polar, being maximum at about 1 degree from the solar limb. Results for the inner corona agree with those obtained by Vashakidse (1949); whilst those for the outer corona are in line with Öhman (1947). Polarization of the K (electron) component at 1.2 solar radii was 64%, close to that predicted theoretically. D.R.Barber

523.755

37. ANALYSIS OF A CORONAL CONDENSATION. M.Waldmeier.
Z. Astrophys., Vol. 40, No. 4, 221-35 (1956). In German.

The region of a coronal condensation over a large sunspot group has shown for the line 5694 A an equivalent width of 34×10^{-6} A in the spectrum of the sun's centre. The intensity of its continuous spectrum was 1×10^{-5}. From these observations a mean electron density of 45×10^{8} cm^{-3} has been deduced and a maximum value of 82×10^{8} cm^{-3}. The ionization temperature amounts to about 2×10^{6} degrees. One has to distinguish between permanent and sporadic condensations. Sporadic condensations very often occur in an already existing permanent condensation. The line 5303 A, invisible in the permanent condensation, has shown an intensity of 180×10^{-6} in a sporadic condensation. This line displays Doppler shifts up to 38 km/sec. Under the assumption that the excitation of the line 5303 is produced by electron collisions, the ratio of the abundances of H : Fe is found to 1.4×10^{4}. The permanent condensation is a region of high density and temperature. The sporadic condensation may originate from the permanent condensation by a decrease of the temperature or the density. A.

523.76

38. A STUDY OF MAGNETIC MAPS OF THE SUN. M.B.Wood.
Astrophys.J., Vol. 124, No. 2, 447-50 (Sept., 1956).

Bipolar- and unipolar-type magnetic regions have been identified and related to other types of solar activity. Unipolar regions have been studied relative to the geomagnetic disturbance figure, Ap; no definite relationships could be recognized from the available data, and thus no identification of these regions with solar "M" regions could be established. A.

523.77

39. THE PROFILE OF THE BRACKETT ALPHA LINE IN THE SOLAR SPECTRUM. C.de Jager, M.Migeotte and L.Neven.
Ann. Astrophys., Vol. 19, No. 1, 9-18 (1956).

The profile of the Brackett α line, H_{4-8} in the solar spectrum was determined from records obtained at the Jungfraujoch. The line profile, although strongly blended with an atmospheric band of N_2O can be determined with a fair accuracy. The profile computed on the basis of the Holtsmark theory and by using the complete Stark splitting pattern of the line agrees with the observed one. An earlier conclusion, that the observed solar Paschen and Brackett lines are wider than the computed ones is incorrect. A.

523.77 : 523.755

40. OBSERVATIONS OF THE STRUCTURE OF THE INNER CORONA OUTSIDE ECLIPSE [AT TIMES OTHER THAN ECLIPSE] IN THE 5303 A LINE. M.G.Karimov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 2, 205-6 (1956). In Russian.

Regular observations of the solar corona were made with an extra-eclipse spectrograph at heights of 2600 m above sea-level at the corona station near the Great Alma-Ata lake. Emission lines at 5303 and 6374 A were photographed on a diffraction spectrograph fixed to the eyepiece part of the coronograph and observations were made to within 1' of arc of the sun's edge. Structure photographs were also taken using an interference-polarization filter. The band-pass of the latter is about 2 A and at 34.9°C the band is centred upon the green coronal line. A thermoregulating device kept temperature constant to $\pm 0.2^{\circ}$C. The variations of intensity across the corona obtained from filter and spectrum photographs show good agreement. C.R.S.Manders

523.77

41. INTERPRETATION OF FRAUNHOFER-LINE PROFILES. H.H.Plaskett.
Monthly Not. Roy. Astrom. Soc., Vol. 115, No. 3, 256-69 (1955).

From the experimentally determined cross-section of the Na atom for collisions of the second kind is shown that the hypothesis of true absorption is probably not applicable to the formation of Fraunhofer lines in the solar photosphere. Using atomic transition probabilities for radiative excitation and ionization, values of the source functions and the ratio of the line to the continuous absorption coefficients are derived in terms of kinetic, excitation and ionization temperatures. The functional dependence of these quantities on the optical depth is such as to permit a numerical integration of the exact equation of transfer, and the method of effecting this integration is outlined. A.

523.77

42. AN INTERFEROMETRIC INVESTIGATION OF THE EFFECT OF HYPERFINE STRUCTURE ON SOLAR LINE PROFILES. W.R.Hindmarsh.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 3, 270-8 (1955).

Abt has discussed the possible influence of hyperfine structure on solar line profiles. Allowing for hyperfine structure, and with the aid of detailed assumptions concerning physical conditions on the sun, he reproduced the Utrecht profile of the weak manganese line λ 5516.8. This paper describes the interferometric investigation of the moderately strong manganese lines $\lambda\lambda$ 6021, 6016, 6013 and the iron line λ 6027. The method of circular channels was used, but with the line under examination at the centre of the heterochromatic fringe system. A solar absorption coefficient is deduced from the iron line profile, and this is used to compute the profiles of the manganese lines allowing for hyperfine structure. The only major assumption necessary concerning solar conditions is that the lines are all formed in the same level of the solar atmosphere. The computed and observed profiles agree within the limits of experimental error, and are substantially different from the manganese line profiles computed on the assumption of no hyperfine structure. A.

523.77 : 535.417

43. INTERFEROMETRIC MEASUREMENTS OF WAVELENGTHS. II. MEASUREMENTS AT 6500 A AND A GENERAL DISCUSSION OF THE SOLAR RED SHIFT. M.G.Adam.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 4, 405-21 (1955).

For Pt I, see Abstr. 4123 (1954). It has been suggested that the largest wavelength displacement of solar lines to the red will be observed for resonance lines. To test this prediction the wavelengths of a number of lines, including the calcium inter-system resonance line $4\,^1S$-$4\,^3P$, have been measured in the 6500 A region by the method of circular channels. Contrary to the theoretical prediction the resonance line has the smallest red shift which has yet been observed. This resonance line is very faint and it appears to exemplify the phenomenon (frequently referred to by Burns) of a variation in line displacement with line strength. In a discussion of the red shifts at 6500 A, together with the earlier results at 5080 A and 6020 A, it is clear that line strength is the dominating factor affecting the shifts. In order to make a quantitative examination of this effect over all wavelength regions, line strengths are expressed in equivalent "ergs", a unit proportional to the absolute energy absorbed by the line. If Δ (milliangstroms) is the solar red shift at wavelength λ it is shown that there is a linear relation between Δ/λ^2 and the logarithm of the equivalent "ergs", a relationship which is applicable at all wavelengths. 158 solar red shifts measured in the Allegheny Observatory — Bureau of Standards work are analysed in exactly the same way as the 20 Oxford results. These confirm the empirical relationship over a wavelength range extended by 1000 A, and a greatly increased range of line strengths. A.

523.77 : 535.417

44. INTERFEROMETRIC MEASUREMENTS OF WAVELENGTHS. III. A NOTE ON OBSERVATIONAL TECHNIQUE IN THE METHOD OF CIRCULAR CHANNELS. M.G.Adams.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 4, 422-6 (1955).

While the method of circular channels has unique advantages for wavelength measurements, it is more sensitive to errors due to irregularities in the interferometer plates, than is the usual method of parabolic channels. The experimental

arrangement is examined from this point of view, and it is shown that by slight changes in the original set up errors in the absolute wavelengths due to plate irregularities, can be reduced to less than 0.001 A. A.

523.77

45. CENTRE-LIMB VARIATIONS IN THE EQUIVALENT WIDTHS OF SOME INFRA-RED FRAUNHOFER LINES. B.E.J.Pagel.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 5, 493-520 (1955).

Using tracings recorded on Mount Wilson with the McMath–Hulbert Observatory duplicate infrared spectrometer, the equivalent widths of nine Fe I lines in the neighbourhood of λ 15 500 with excitation potentials close to 5.60 volts have been measured at angles of emergence from the solar surface corresponding to μ = 1.0, 0.8, 0.6, 0.5, 0.4, 0.3 and 0.2. The results were compared with those which would be predicted on the basis of three photospheric models recently put forward by Aller and Pierce, de Jager and Michard. The line profiles were calculated in detail for each model with the aid of modern techniques of high-speed computation, using the EDSAC at the University Mathematical Laboratory, Cambridge. The centre-limb variations in equivalent width calculated from the models differ mainly as a result of differences in the first and second derivatives of the source function close to the surface. The behaviour of the stronger lines observed is best reproduced from the temperature distribution of de Jager, while that of the weaker lines (except close to the limb) is more consistent with those of Aller and Pierce, and Michard. Finally, the observations were used for an inductive determination of the temperature distribution; this distribution was then corrected to give agreement with the observational data. The final model thus obtained agrees closely in the deeper layers ($\tau_0 \geq 0.06$) with Michard's model. In the outer layers, the temperature gradient is considerably steeper, as in de Jager's model, but the additional feature of a temperature inversion appears very close to the surface ($\tau_0 = 0.015$). It is suggested that a model of this type may be consistent with observations of the intensity of the continuum at the extreme limb, as well as with the observed behaviour of Fraunhofer lines. A.

523.775

46. THE TEMPERATURE AND EQUILIBRIUM OF HYDROGEN IN SOLAR PROMINENCES. H.Zirin.
Astrophys. J., Vol. 124, No. 2, 451-60 (Sept., 1956).

The Hα, Hβ and D3 emission lines of solar prominences in active coronal regions have been photographed with 16 in. coronagraph and a high-dispersion spectrograph. The Doppler profiles, after elimination of turbulent motion, give temperatures ranging from 7000° to 50 000°K, depending on the nature of the prominence involved. The statistical equilibrium of hydrogen in a solar prominence at temperatures of 25 000°-200 000° is analysed. Among the most important processes are found to be collisional excitation from the ground state and photoexcitation from the second level by photospheric radiation. Hardly any of the models are optically deep in Hα; the critical question turns out to be the Lyman-α depth; if this is large, the prominence radiates strongly in Hα, and vice versa. A.

523.775

47. INTERFEROMETRIC MEASUREMENTS OF THE GREEN CORONA LINE DURING THE TOTAL SOLAR ECLIPSE OF 1954 JUNE 30. A.H.Jarrett and H.von Klüber.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 4, 343-62 (1955).

A detailed description is given of a successful attempt to observe interference fringes with a Fabry–Perot interferometer from the 5303 A corona line during a total eclipse. Low-absorption coatings for the interferometer and a narrow pass-band interference filter (equivalent width of ~ 25 A of the continuous spectrum, peak transmission 25%) were employed. In spite of thin cloud during totality, which was estimated to have reduced the available intensity by a factor of 2, it probed possible to measure fringe half-widths for various position angles and distances from the solar limb. The measurements seem to indicate a decrease of the line widths with increasing distance from the sun. Interpreted in terms of kinetic temperatures, T = 2.2 x 10^6 to 5 x 10^6 deg. K, with most values near 2.5 x 10^6, for regions situated 1.05 to 1.3 radii from the solar centre. Improvements to the equipment for a future occasion are suggested. A.

523.872 : 523.164.4

48. EXCITATION IN NEBULAE: CHARGE TRANSFER AND THE CASSIOPEIA RADIO SOURCE. J.W.Chamberlain.
Astrophys. J., Vol. 124, No. 2, 390-8 (Sept., 1956).

The recent analysis by Minkowski and Aller of the spectrum of this filamentary nebulosity is extended and modified. A consistent explanation of the large [O I]/Hα and [O I]/[O II] intensity ratios for filament 1 is obtained on the basis of collisional excitation with normal abundances and $T_e < 12\,000°K$. The hydrogen is over 90% neutral. It is shown that O^+ will be readily transformed to O through charge-transfer collisions with H; hence large electron densities need not be invoked to explain the weak [O II]. Attention is directed toward difficulties presented by the hypothesis that the observed O^{++} is left from an earlier state of the nebula. Alternatively, it is suggested that [O III] arises from the narrow high-temperature region immediately following a strong shock wave. A larger and cooler portion of the nebulosity, farther behind the shock wave, gives rise to [O I]. The excitation of filaments 2 and 3 is discussed briefly; without more data, their solution is not so clarly defined, but they probably are excited by weaker disturbances in the nebulosity. The question of the relationship between the optical and the radio emission is discussed briefly. A.

523.872

49. ON SYNCHROTRON RADIATION FROM MESSIER 87. G.R.Burbidge.
Astrophys. J., Vol. 124, No. 2, 416-29 (Sept., 1956).

The recent discovery by Baade that the optical radiation emitted by the jet in M87 is strongly polarized — and thus is synchrotron radiation — is a confirmation of a prediction made by Shklovsky and others. In this paper calculations of the required conditions of magnetic-field and particle energies are made, for both the optical and the radio emission. To account for the optical radiation in the jet, the total energy required in particles and field ranges from about 10^{54} to 10^{59} ergs for a series of assumed magnetic fields ranging from 10^{-2} to 10^{-6} gauss. To account for the radio emission for the same series of magnetic-field strengths, total energies in the range 10^{56}-10^{61} ergs are demanded. It is suggested that reasonable values are about 2 x 10^{55} ergs in particles and field with $H \cong 10^{-3}$ gauss in the jet and about 10^{57} ergs in a volume 200 times greater than that of the jet, also with $H \cong 10^{-3}$ gauss, which will explain the radio emission. By considering nuclear collisions of the high-energy protons with the static material present in the jet, it is shown that a continuous supply of electrons and positrons will be produced. If a density of about 3 x 10^{-22} g/cm^3 is assumed in the jet, the rate of electron-positron energy generation will be sufficient to balance the loss of energy by synchrotron radiation. The jet will also be a source of high-energy gamma radiation. Energy sources which might give rise to the primary particles and magnetic fields are discussed. It is suggested that the presence of antimatter in M 87 would lead to a very powerful source of high-energy electrons and positrons. A.

523.877

50. THE SOURCE FUNCTION FOR AN EQUILIBRIUM GRAY ATMOSPHERE. J.I.F.King.
Astrophys. J., Vol. 124, No. 2, 406-11 (Sept., 1956).

The exact form of the source function for a finite gray atmosphere in radiative equilibrium (planetary thermal problem) is derived. It proves to be expressible in terms of the X- and Y-functions of Chandrasekhar. An unexpected result is that Hopf's function $q(\tau)$ is shown to be, apart from a numerical factor, equivalent to the second functional moment of X and Y. A.

523.877

51. ON CLUSTER-TYPE VARIABLES AND MAGNETIC FIELDS. G.R.Burbidge.
Astrophys. J., Vol. 124, No. 2, 412-15 (Sept., 1956).

It is shown that a comparison of the observed with the available theoretical values of the period–density relation for giant models, applied to the cluster-type variables, cannot be expected to show good agreement at the present time. However, the effect of a magnetic field, similar to that observed in RR Lyrae, is explored, and it is shown that, for field distributions such that $H_{central}/H_{surface} \cong 10^3$, changes of the period of a few % can be expected. A brief qualitative discussion of the

effect of a strong magnetic field on a degenerate stellar core is given. A.

523.877

52. FINITE ATMOSPHERES WITH ISOTROPIC SCATTERING. I.W.Busbridge.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 5, 521-41 (1955).

Some transfer problems in plane parallel atmospheres of finite optical thickness τ_1 are considered, the scattering being isotropic with albedo ω ($o < \omega \leq 1$). The same method is then used to obtain expressions for the emergent intensities at both faces of the atmosphere when there is thermal emission and when it is subject to incident radiation. A.

523.877

53. THE EQUILIBRIUM OF MAGNETIC STARS. S.Chandrasekhar and K.H.Prendergast.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 1, 5-9 (Jan., 1956).

It is shown that in the case of an axially symmetric self-gravitating fluid the magnetic field must be such that $\varpi^2 T = F(\varpi^2 P)$, where T and P are functions defining the toroidal and poloidal fields and ϖ is distance from the axis of symmetry. An explicit differential relation between P and T is obtained in the case of an incompressible fluid. Ferraro's poloidal field and force-free fields are included as special cases. R.A.Newing

523.877

54. ELEMENT-BUILDING REACTIONS IN STARS. W.A.Fowler and J.L.Greenstein.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 4, 173-80 (April, 1956).

In this general review, the possibility is investigated of the formation of the heavier elements from H without recourse to an initial high density phase in the evolution of the universe. It is concluded that many types of stars are now synthesizing elements at least up to carbon and, in the S stars, up to the rare earths. See also Abstr. 9387 (1955). R.A.Newing

523.877 : 523.75

55. INITIAL "ACCELERATION" AND "DECELERATION" IN NOVAE AND SOLAR FLARES. C.E.R.Bruce.
Rep. Brit. Elect. Res. Assoc., Rep. Z/T86, 4 pp. (1951).

Continues the study of the spectra of novae begun in previous reports (Abstr. 2153/1950, 4324/1955). See also abstract following. A.

523.877 : 523.75

56. INITIAL "ACCELERATION" AND "DECELERATION" IN NOVAE AND SOLAR FLARES. C.E.R.Bruce.
Rep. Brit. Elect. Res. Assoc., Rep. Z/T86 Suppl., 7 pp. (1955).

See preceding abstract. The conclusion reached in earlier reports that the broadening of the emission lines in the initial stages of novae is proportional to the square of the wavelength and not to the wavelength, is supported by the measurements made on the spectrum of Nova Cygni 1920. During this stage of the outburst the increase to a maximum and subsequent decrease of the linewidths was very marked. These observations support the view that the latter variation is due to increase and decrease of Zeeman effect, accompanying the rise and fall of the current in the discharge channel, and not to acceleration and deceleration of the gas A.

523.877

57. SIMPLE APPROXIMATE SOLUTIONS OF THE NON-GREY RADIATIVE EQUILIBRIUM PROBLEM. K.Hunger and G.Traving.
Z. Astrophys., Vol. 39, No. 4, 248-68 (1956). In German.

The absorption coefficient and the Planck constant are expressed in the forms $\bar{\kappa}(\bar{\tau}) \cdot x_\nu$ and $B(\bar{\tau}) \cdot b_\nu$, and solutions are obtained (i) for a simple analytical form for $B(\bar{\tau})$ and (ii) using the method of discrete ordinates. It is assumed that x_ν and b_ν take on two values only, and solutions are expressed in terms of the two parameters

$$\bar{x} = \int_0^\infty b_\nu x_\nu d\nu = b_1 x_1 + b_2 x_2, \quad \text{and} \quad (\overline{x^{-2}}) = \int_0^\infty b_\nu x_\nu^{-2} d\nu.$$

The method is illustrated by numerical calculations of the temperature distributions in the sun and in the star τ Sco(BO). R.A.Newing

526.7

58. CONCERNING THE DIRECT MEASUREMENT OF THE ACCELERATION DUE TO GRAVITY. P.Vernotte.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 227-9 (July 16, 1956). In French.

The method of observation of the free fall of a mass in air at reduced pressure is considered and it is shown theoretically that by using two masses of similar (theoretically identical) external form but of different mass the effects of buoyancy and viscous drag may be allowed for and a high order of accuracy in g attained. S.Weintroub

PHYSICS 53

FUNDAMENTALS 530.1

530.12 : 531.18

59. A KINEMATIC INTERPRETATION OF INERTIAL SYSTEMS. T.Mátrai.
Acta phys. Hungar., Vol. 5, No. 4, 409-23 (1956). In German.

An attempt is made to establish the Lorentz transformations without the customary assumptions concerning rigid rods and light signals. A point-clock T is said to be geodesic in the time interval τ_0 to τ if no other point-clock can be found, coinciding with T at least at τ_0 and τ, for which this interval is greater than $\tau - \tau_0$. Two geodesic point-clocks which are never at infinite separation are taken to be at relative rest, and a manifold of such clocks defines an inertial system. Kinematic signals, clock synchronization and spatial distance are defined in terms of these concepts, and the Lorentz equations are established. R.A.Newing

530.12 : 530.145

60. THE RELATIVISTIC MOTION OF A POINT MASS IN THE CASE OF A GENERAL FORCE. G.Szamosi.
Acta phys. Hungar., Vol. 5, No. 4, 463-9 (1956). In German.

Previous work (Abstr. 4341/1955) is extended to the case in which the force is not necessarily a potential field; the rest mass is then of the form $M_0 = m_0 + Q/c^2$, where Q is the line integral of the world force (the Minkowski work function) and the energy is $E = M_0 c^2 (1 - v^2/c^2)^{-1/2}$. The general nature of the motion is discussed in detail in the case of world forces with zero time components and applications to nuclear fields are indicated. Modifications in the Dirac equation arising from the term Q are briefly considered, and it is noted that Q plays the role of a potential. R.A.Newing

530.12

61. THEORY OF THE ELASTIC COLLISION OF PARTICLES IN MINKOWSKI SPACE–TIME. J.Romain.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 41, No. 11, 1225-41 (1955). In French.

The theory is developed in terms of the geometrical resolution into two or more components of the resultant momentum 4-vector of a system of particles, and applications include collisions involving the creation and annihilation of photons and particles. The discussion is concerned mainly with two- and three-particle collisions, but "double Bremsstrahlung" is considered as a simple example of a four-particle problem. R.A.Newing

530.12 : 531.51

62. NOTE ON THE APPLICATION OF THE PAULI RING TO FORM THE METRIC TENSOR IN THE GENERAL THEORY OF RELATIVITY. W.Słowikowski.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 4, No. 6, 313-20 (1956).

A linear 4-space P is introduced, the components of a P-vector being elements of the Pauli ring. The tensor g_{ij}

is defined in terms of the scalar products of the components of a P-vector g_i and it is shown that $|g_{ij}| < 0$. A correspondence is noted between tensor equations and P-scalar equations involving the invariant differential operator $g^{ij}\partial_j$. The Maxwell equations and the Dirac equation in flat space-time are expressed in terms of the notation developed. R.A.Newing

530.12

63. DEFINITION OF AN INVARIANT VOLUME ELEMENT FOR A MOVING SYSTEM. E.Durand.
C.R. Acad. Sci. (Paris), Vol. 243, No. 4, 354-7 (July 23, 1956). In French.

The 3-volume element of a body moving with uniform velocity v relative to the frame (x_1, x_2, x_3) is defined to be $(1 - v^2/c^2)^{-1/2}dx_1dx_2dx_3$, with $dx_4 \equiv icdt = 0$, in order that the transformation properties of volume integrals in Minkowski space-time shall be the same as those of the integrands. The definition is extended to the case in which $dx_4 \neq 0$. R.A.Newing

530.12 : 531.18

64. DEFINITION OF AN INVARIANT SURFACE ELEMENT AND A UNIT FOUR-VECTOR FOR A MOVING SURFACE. E.Durand.
C.R. Acad. Sci. (Paris), Vol. 243, No. 5, 480-3 (July 30, 1956). In French.

The surface element is defined in terms of the vector $\Delta S^p = V_q \Delta \tilde{S}^{pq}/ic$, where V_q is the 4-vector velocity, $\Delta \tilde{S}^{pq}$ is the dual of ΔS^{pq} with $\Delta S_{pq} = \Delta_1 x_p \Delta_2 x_q - \Delta_1 x_q \Delta_2 x_p$. In the rest-frame, $\Delta S_4 = 0$ and the space components give the 3-space surface element and normal. Applications to electromagnetic theory are indicated. R.A.Newing

530.12

65. DEFINITION OF AN INVARIANT ELEMENT OF LENGTH AND OF AN ANTISYMMETRIC TENSOR WHICH GENERALIZES THE UNIT TANGENT VECTOR TO A CURVE WHEN THE LATTER IS IN MOTION. E.Durand.
C.R. Acad. Sci. (Paris), Vol. 243, No. 6, 570-2 (Aug. 6, 1956). In French.

The invariant spatial distance is defined to be $(dl)^2 = g_{jk}dx^jdx^k + c^{-2}(v_kdx^k)^2$, where v_k is the 4-vector velocity. The 3-space unit tangent vector is replaced by the tensor $\lambda^{km} = (v^mdx^k - v^kdx^m)/icdl$. Simple line integrals in electromagnetism are expressed in terms of the new notation.

R.A.Newing

530.12 : 532.51

66. ON CERTAIN HYDRODYNAMICAL CONSIDERATIONS OF AN IMPERFECT FLUID IN A GENERAL RELATIVISTIC FIELD. S.Bhattacharya.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 501-2 (Aug., 1956).

An expression is derived for the rate of change of circulation with respect to proper time around a closed curve moving with the fluid. R.A.Newing

530.12

67. CONTRIBUTION TO STEPHENSON–KILMISTER'S UNIFIED THEORY OF GRAVITATION AND ELECTROMAGNETISM. J.I.Horváth.
Nuovo Cimento (Ser 10), Vol. 4, No. 3, 571-6 (Sept., 1956).

A geometrical interpretation for Stephenson–Kilmister's unified theory of gravitation and electromagnetism is given on the basis of Finslerian geometry. It is known that the correct equations of motion for a charged test body moving in the Riemannian space under the ponderomotive influence of the electromagnetic field can be deduced from a variational principle with the Lagrangian: $\mathcal{F}(x,dx) = A_\mu(x)dx^\mu + \{g_{\mu\nu}(x)dx^\mu dx^\nu\}^{1/2}$, where $A_\mu(x)$ and $g_{\mu\nu}(x)$ are the components of the potential of the electromagnetic field and the components of the metric ground tensor of the original Riemannian space, respectively. Considering $\mathcal{F}(x, dx)$ as the ground function of a Finslerian space a reformulation of Stephenson–Kilmister's idea is suggested. A.

530.12

68. A UNIFIED THEORY OF GENERAL RELATIVITY OF GRAVITATION AND ELECTROMAGNETISM. L.P.Eisenhart.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 5, 249-51 (May, 1956).

The proposed theory is based on a symmetric g_{ij} and coefficients of connection $\Gamma^i_{jk} = \{^i_{jk}\} + g^{ih}F_{jk;h}$, where F_{jk} is the electromagnetic tensor. The field equations are taken to be $\Gamma_{jk} \equiv R_{jk} - F_j{}^m{}_{;h}F_k{}^h{}_{;m} = 0$. R.A.Newing

530.12

69. CONSTRUCTION OF A FUNDAMENTAL SYSTEM OF PHYSICAL DIFFERENTIAL OPERATORS FOR ANY UNIVERSE WITH A SIMPLE BASIC GROUP. AUTONOMOUS DEDUCTION OF THE GENERALIZED SCHRÖDINGER EQUATION IN THE THEORY OF DEFINITIVE RELATIVITY. L.Fantappiè.
R.C.Accad. Naz. Lincei, Vol. 19, No. 5, 213-17 (Nov.); No.6, 367-73 (Dec., 1955). In Italian.

A detailed development is given of the author's thesis that the operators are uniquely determined by the fundamental transformation group of the physical system considered, and the results are applied to the author's relativistic theory which is based on the group Fn^{10}_{3+1} (Abstr. 5210, 7671/1955). A generalized wave-equation is obtained without appeal to non-quantum physics, and this reduces to the Klein–Gordon equation in the limit $R \to \infty$, where R is the radius of the universe. R.A.Newing

530.12

70. ON THE PHYSICAL SIGNIFICANCE OF THE THEORY OF "DEFINITIVE RELATIVITY". G.Arcidiacono.
R.C. Accad. Naz. Lincei, Vol. 20, No. 4, 463-9 (April, 1956). In Italian.

The theory based on Fantappiè's group Fn^{10}_{3+1} is discussed in terms of the geometry of 4-space, and its relation to certain meson field theories possessing invariance with respect to rotations in 5-space is emphasized. Transformation equations analogous to those of Lorentz are obtained and include, in addition to transformations between moving observers, transformations between observers separated by large spatial or temporal intervals. R.A.Newing

530.12 : 535.225

NEW OPTICAL ETHER DRIFT EXPERIMENT. See Abstr. 209

530.145

71. ON A NEW TYPE OF INTERACTION BETWEEN NUCLEONS. P.Szépfalusy.
Acta phys. Hungar., Vol. 6, No. 1, 87-103 (1956).

The purpose of the present paper is to attempt the description of the properties of a particle system consisting of protons and neutrons with the aid of a non-linear Schrödinger equation. The non-linearity of the equation is due to the fact that the interaction between more than two particles leads to many-body forces by definition. A more remote purpose of this concept is to interpret the saturation properties and shell structure of the nucleus. The present paper, however, is restricted to showing the consequences and results in the treatment of the ground state of the deuteron following from the assumption of a non-linear equation. A.

530.145 : 539.18

72. TABLE OF PROPERTIES OF THE "ELEMENTARY" PARTICLES. A.M.Shapiro.
Rev. mod. Phys., Vol. 28, No. 2, 164-70 (April, 1956).

Divided into two sections for established particles and for particles whose properties are not well determined; this latter class includes all the K^+- and K^--mesons with the exception of the τ-meson. The best values of the mass, mean life and magnetic moment are listed for each particle together with the spin, parity, isotopic spin (T and T_z) and Gell-Mann's "S" value. D.J.A Prowse

530.145

73. ON THE CAUSAL INTERPRETATION OF QUANTUM THEORIES. F.Čap.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 3, 418-32 (1956).

Summarizes and criticizes the many recent publications on this subject, and discusses whether the classical theory, modified by assuming charged particles to be acted on by damping forces of arbitrary form, can be made to predict the quantized energy states and transitions. P.M.Davidson

530.145

74. REMARKS ON HEISENBERG'S NON-LINEAR FIELD THEORY. H.Kita.
Progr. theor. Phys., Vol. 15, No. 1, 83-5 (Jan., 1956).

It is claimed that Heisenberg's formalism, or at any rate his proposed sequence of approximations, is not self-consistent. In a certain approximation it is found that the behaviour of the propagator at large distances has a reality character other than that postulated. J.S.Bell

530.145

75. ON THE DEDUCTION OF THE DIRAC—FOCK—PODOLSKI EQUATIONS FROM THE QUANTUM THEORY OF FIELDS. K.L.Nagy.
Acta phys. Hungar., Vol. 6, No. 1, 143-7 (1956).

The equation of the many-time formalism is derived from the generalized Schrodinger equation in the interaction representation for a state of the system on an arbitrary space-like surface. P.T.Matthews

530.145

76. COVARIANT HYPERQUANTIZATION. J.M.Jauch.
Helv. phys. Acta, Vol. 29, No. 4, 287-312 (1956).

The differential equations for the vacuum expectation values of chronological products of field operators are transcribed into an operator formalism which is covariant under the Lorentz group. This is accomplished by introducing a new set of field operators with the same transformation properties as the ordinary fields to which they correspond. They operate in a certain linear vector-space Ω and they satisfy very simple commutation rules. The vectors in Ω have no relations to the state-vectors of the system. They represent instead the solutions of the Heisenberg field equations provided they are suitably restricted by certain subsidiary conditions, subsequently called the field-conditions. The vectors which satisfy these conditions are constructed in closed form. It is shown that the scalar product in Ω cannot be the positive definite product characteristic for the Hilbert space. In fact the scalar product in Ω must be symmetrical in the two factors for a covariant formalism. A.

530.145 : 530.12

77. QUANTUM THEORY OF WAVE FIELDS IN A CURVED SPACE. M.Gutzwiller.
Helv. phys. Acta, Vol. 29, No. 4, 313-38 (1956).

Wave fields are studied in a space-time continuum whose curvature is independent of the physical phenomena. It is shown that a space of constant curvature is the most natural choice for this purpose, not only because of its geometrical simplicity, but because it guarantees the maximum number of certain constants of motion and leads to a propagation formula whose kernel is only a function of the geodesic distance. Therefore a de Sitter space is investigated in detail. A complete set of solutions is discussed for the scalar wave-equation and for the first-order wave equation of Dirac. Hadamard's propagation formula is written in a particularly symmetric form with the help of a propagation function which is similar to the well known D-function in flat space. A generalization for spinors and electromagnetic fields is given. In the latter case Huygens' principle is shown to hold even in this space of constant curvature. A second general propagation formula is established whose kernel is again related to Hadamard's elementary solution. But it leads now to a propagation function which is similar to the D_1-function in flat space. Using this new propagation formula, every solution of the homogeneous wave-equation (with a mass term) can be split into a sum of two such solutions which are shown to belong to two distinct classes. This separation is uniquely determined and invariant with respect to the group of motions. Moreover in the case of a spinor field these two classes are transformed into each other by the operation of charge conjugation. Therefore they are interpreted as states of "positive energy" and "negative energy", although there does not exist in this space an operator like the Hamiltonian in flat space. Finally the various propagation functions are represented as sums over the complete sets of solutions which were mentioned previously. As an example a process of second quantization is applied to a spinor field which is coupled to a pseudoscalar field. The method imitates the old non-relativistic procedure for a particular space-like surface, but the result is invariant and compatible with the field equations. If the coupling between pseudoscalar and spinor field vanishes, all the field operators can be explicitly stated in terms of the complete sets of solutions. This leads at once to general commutation rules using Hadamard's propagation formula. Moreover the vacuum can be defined in accordance with Dirac's hole theory. Therefore all the necessary elements are assembled for studying the various radiation effects in this more general scheme. A.

530.145

78. ON SUMS OVER TRAJECTORIES FOR SYSTEMS WITH FERMI STATISTICS. D.J.Candlin.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 231-9 (Aug., 1956).

A recent derivation (Abstr. 7152/1956) of the Feynman action principle from the canonical formulation is extended to systems with Fermi statistics. A.

530.145

79. QUANTIZATION IN THE FUNCTIONAL THEORY OF PARTICLES. J.L.Destouches.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 3, 433-68 (1956).

A peculiar formulation of quantum mechanics is expounded. G.E.Brown

530.145

80. MASS REVERSAL AND SPACE TIME INVERSIONS. S.Watanabe.
Progr. theor. Phys., Vol. 15, No. 1, 81-3 (Jan., 1956).

The selective prescription of mixing interactions proposed by Ouchi, Senba and Yonezawa (Abstr. 7962/1956) is not conclusive since it involves a change of sign of a natural constant, and may be altered by postulating compensating sign changes for other constants. P.T.Matthews

530.145

81. THE RENORMALIZATION GROUP IN QUANTUM ELECTRODYNAMICS. N.N.Bogolyubov and D.V.Shirkov.
Dokl. Akad. Nauk SSSR, Vol. 103, No. 2, 203-6 (1955). In Russian.

Multiplying the propagators and charge by certain constant factors does not change the physical content of the theory. It leads to the presence of the renormalization group. Because of this group it is possible to simultaneously change the momentum scale and the charge, preserving the equations between propagators. The Lie equations for this group are written down. G.E.Brown

530.145

82. APPLICATION OF THE RENORMALIZATION GROUP TO IMPROVEMENT OF PERTURBATION THEORY FORMULAE. N.N.Bogolyubov and D.V.Shirkov.
Dokl. Akad. Nauk SSSR, Vol. 103, No. 3, 391-4 (1955). In Russian.

The change of momentum scale (see preceding abstract) is used to find the propagator in the asymptotic region [but $e^2 \ln(k^2/m^2)$ is assumed small compared with unity] and the infrared region from the results of perturbation theory. G.E.Brown

530.145

83. A CERTAIN GENERALIZATION OF THE RENORMALIZATION GROUP. A.A.Logunov.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 793-5 (1956). In Russian.

The theory of Bogolyubov and Shirkov (see two preceding abstracts) is generalized to the case of arbitrary longitudinal photon pairing. G.E.Brown

530.145

84. NOTE ON THE LEHMANN'S MODIFIED PROPAGATORS. K.Hiida and M.Sawamura.
Progr. theor. Phys., Vol. 14, No. 2, 167-9 (Aug., 1955).

The method by which Lehmann (Abstr. 5288/1954) obtained expressions for the renormalized modified propagators is here employed to obtain expressions for the unrenormalized modified propagators. When renormalized (without recourse to the perturbation method) they give Lehmann's formulae. P.M.Davidson

530.145

85. SOME REMARKS ON THE APPLICABILITY OF THE FIELD THEORY FROM THE STANDPOINT OF THE DISTRIBUTION ANALYSIS. H.Wakita.
Progr. theor. Phys., Vol. 14, No. 3, 260-1 (Sept., 1955).

It is argued that, in quantum electrodynamics, the divergencies arise not from a faulty Schrödinger equation but from an inadmissible method of computation in the perturbation expansion involving the products of Δ-type functions. W.A.Hepner

530.145

86. ON THE RENORMALIZATION THEORY OF QUANTUM ELECTRODYNAMICS. S.Kamefuchi and U.Umezawa.
Progr. theor. Phys., Vol. 15, No. 3, 298-300 (March, 1956).

In the limit of cut-off momentum going to infinity, it is shown that as the bare coupling constant varies from zero to infinity the range of the renormalized constant shrinks to zero.
P.T.Matthews

530.145

87. RENORMALIZATION WITH PSEUDO-VECTOR COUPLING. H.S.Green.
Nuclear Physics, Vol. 1, No. 5, 360-2 (1956).

It is claimed that the renormalization procedure of Arnowitt and Deser (Abstr. 85/1956) is equivalent to that developed by the author (Abstr. 3861/1953) and that finite results can also be obtained by medium coupling methods.
P.T.Matthews

530.145

88. INTERACTION OF ANTINUCLEONS IN MATTER. I. J.Iwadare and S.Hatano.
Progr. theor. Phys., Vol. 15, No. 2, 185-7 (Feb., 1956).

This theoretical paper summarizes "our knowledge about the properties of antinucleons other than the production processes". The specific topics discussed are selection rules for annihilations, nucleon–antinucleon forces, and the behaviour of slow antiprotons. J.S.Bell

530.145

89. ON THE RENORMALIZATION CUT-OFF. H.Umezawa, S.Kamefuchi, Y.Tomozawa and M.Konuma.
Progr. theor. Phys., Vol. 15, No. 4, 417-19 (April, 1956).

Outline of a cut-off procedure leading to the ordinary renormalized Green's functions independent of the cut-off momentum, which appears only in the Z factors.
P.T.Matthews

530.145

90. INTRODUCTION OF RELATIVISTIC CAYLEY–KLEIN PARAMETERS IN THE HYDRODYNAMIC REPRESENTATION OF THE DIRAC EQUATION. G.Jakobi and G.Lochak.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 234-7 (July 16, 1956). In French.

In a causal theory expressed in terms of a model fluid with intrinsic spin, the Hamiltonian for the motion is expressed in terms of relativistic Eulerian angles which are related to the tensor concomitants of the Dirac equation.
R.A.Newing

530.145

91. REMARKS ON A MATHEMATICAL FORMULATION OF THE MODEL OF GELL-MANN. G.Racah.
Nuclear Physics, Vol. 1, No. 4, 302-3 (1956). In French.

The mathematical formulation of d'Espagnat and Prentki (Abstr. 2668/1956) of the Gell-Mann model is re-presented from an elementary point of view without the complicated symbolism and notation of the original. D.J.A.Prowse

530.145

92. NONLINEAR SPINOR FIELD. R.Finkelstein, C.Fronsdal and P.Kaus.
Phys. Rev., Vol. 103, No. 5, 1571-9 (Sept. 1, 1956).

A classical spinor field is defined by a variational principle on a Lagrangian with quadratic Dirac and quartic Fermi terms. Localized (particle-like) solutions are found within a class of comparison functions which make the angular momentum stationary for a given charge. It is found that the existence of eigensolutions depends in a radical way on the parameters of the Lagrangian, but that the observable properties of those solutions which do exist depend little on these parameters. A.

530.145

93. A NOTE ON THE STATIC APPROXIMATION OF THE NUCLEON ANOMALOUS MAGNETIC MOMENT. A.Kanazawa.
Progr. theor. Phys., Vol. 14, No. 4, 397-8 (Oct., 1955).

The static approximation of the anomalous magnetic moment of the nucleon is open to doubt because it is difficult to perform the charge renormalization. The covariant case is analysed to determine what parts are calculated in the static approximation. It is concluded that in the usual static approximation method only a part of the charge renormalization term can be obtained. D.J.A.Prowse

530.145

94. ON THE PROBLEM OF UNQUANTIZED RELATIVISTICALLY INVARIANT RENORMALIZED EQUATIONS FOR A THREE-DIMENSIONAL EXTENDED PARTICLE.
Yu.M.Shirokov and D.G.Sannikov.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 113-20 (1956). In Russian.

A system of relativistically invariant equations for a spatially smeared out particle interacting with a field has been obtained by applying the method proposed earlier (Abstr. 9931/1954) for constructing a three-dimensional extended particle. The conservation laws have been formulated for the total four-dimensional energy–momentum vector. The particle is stable without the necessity of invoking any additional forces of the Poincare pressure type. An exact renormalization of the mass has been made. For sake of comparison with other known equations a rigorous limiting transition is performed to a point particle. Interaction with an electromagnetic field and scalar meson field is also considered. A.

530.145

95. INTERACTION OF A NUCLEON WITH THE MESON FIELD. N.S.Kalitzin.
Acta phys. Hungar., Vol. 6, No. 1, 1-13 (1956). In German.

The equation investigated is in a six-dimensional pseudo-Euclidean space,

$$\{\alpha_\sigma \frac{\partial}{\partial x_\sigma} - i\alpha_7 m_0\}\Psi = 0$$
$$\sigma = 1, 2 \ldots 6.$$

Invariance properties of the α's and Ψ's are discussed. Coupling to a tensor meson field is introduced. G.E.Brown

530.145

96. ON AN OPERATIONAL METHOD OF SOLVING THE KLEIN–GORDON EQUATION. L.Infeld and J.Plebański.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 4, No. 4, 215-19 (1956).

The Klein–Gordon equation (for the Green function) may be written in two alternative forms, one formally similar to that of an oscillator with a natural frequency n involving the ∇^2-operator, and the other formally similar to a Yukawa equation with a mass m involving $\partial^2/\partial t^2$. Solutions are then found by means of these analogies, after establishing a definite meaning for the operators n and m. L.Pincherle

530.145

97. HYPERONS AS EXCITED STATES OF NUCLEONS. A POSSIBLE MECHANISM FOR MULTIPLE PRODUCTION OF PARTICLES. M.A.Markov.
Dokl. Akad. Nauk SSSR, Vol. 101, No. 3, 449-52 (1955). In Russian.

Excited states in the deformable form-factor theory (Abstr. 7992/1956) are viewed as hyperons and the constants in the theory are set to give the correct energy and lifetime for the Λ^0. Multiple π-production can occur as a cascade down from a highly excited state. Other hyperons are fitted into the scheme. G.E.Brown

530.145

98. NOTE ON A VARIANT OF NON-LOCAL FIELD EQUATIONS. A.R.Asanov.
Zh. éksper. teor. Fiz., Vol. 30, No. 3, 619-20 (1956). In Russian.

Quantum states of the internal coordinates in Markov's theory (see preceding abstract) are derived and classified.
G.E.Brown

530.145

99. A REMARK ABOUT THE SYSTEMATICS OF HYPERONS AND HEAVY MESONS. M.Markov.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 5, 814-17 (1956). In Russian.

The considerations contained in earlier papers (International Conference on Elementary Particles, Pisa, 1955, Abstr. 7992/1956 and two preceding abstracts) about the nature of hyperons and K-mesons lead to a scheme which is very similar to that suggested by Gell-Mann. However, it seems possible to ascribe a well-defined physical meaning to the "strangeness" S. If one refers to a quantized oscillator as a quantum mechanical model, and zero amplitude oscillations are supposed to correspond to neutrons and protons (n_0, p_0), hyperons may be regarded as excited states of nucleons: the first excited level corresponds to Λ^0 and Σ (n_1, p_1), the second

excited level to Ξ hyperons ($n_2, \ldots$) and, in principle, hyperons corresponding to excited levels of any order are possible. The quantum number of the excited state of the hyperons is shown to coincide with the number S (S = 0, 1, 2, ...), the selection rule $\Delta S = \pm 1$ defining the transitions between contiguous excited levels. Next, it is assumed that nucleons and antinucleons may combine into bosons, e.g. $\pi^0 \equiv \pi_{0,0} \equiv (p_0 + p_{-0})$; $\pi_{0,-1} \equiv (p_0 + p_{-1}) \equiv \theta^0$; $\pi_{e,-S} \equiv (p_e + p_{-S})$. Under these assumptions and with the help of the experimental material available at present, production and decay reactions are analysed and discussed, and the selection rules deduced from the author's scheme are compared with those deduced from that of Gell-Mann. This gives the clue to a simple interpretation of the conservation of S in strong or in electromagnetic interactions and of its non-conservation in weak interactions ($\Lambda^0 \rightarrow p + \pi^+$); it corresponds to the conservation of the excitation number of the nucleons (i.e. of the number of nucleons in each single excitation act). This rule, however, does not appear to be an absolute law and fails either at very high energies or for very short interaction times. G.Martelli

530.145

100. A PARTICULAR MODEL IN QUANTUM FIELD THEORY. V.G.Solov'ev.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 6, 1041-4 (1956). In Russian.

The nucleon propagator is obtained exactly in this special model in which the momenta of the intermediate mesons are limited to zero; i.e. the meson field is spread uniformly over space. Renormalization in this theory is discussed.
G.E.Brown

530.145

101. NON-RELATIVISTIC REGULARIZATION OF THE S-MATRIX. B.M.Stepanov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 6, 1045-7 (1956). In Russian.

The regularized Lagrangian is taken as non-local and the form-factors in momentum space are taken to depend on the three-momenta. After the regularization is carried out (and the form-factors become local), relativistic invariance is regained. The effective Hamiltonian is kept Hermitian.
G.E.Brown

530.145 : 539.152.1

102. ON THE EXISTENCE OF A BOUND NUCLEON–Λ^0 STATE. G.H.Derrick.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 565-70 (Sept., 1956).

A variational method is used to find an upper limit to the strength of the nucleon–Λ^0 force from the measured binding energy of the hyper-triton. The force so found is too weak to lead to a bound nucleon–Λ^0 state. A.

530.145

103. Λ^0–NUCLEON FORCES. D.B.Lichtenberg and M.Ross.
Phys. Rev., Vol. 103, No. 4, 1131-2 (Aug. 15, 1956).

The forces binding Λ^0 hyperons in nuclei appear to be strong and highly spin-dependent; it is shown here how this result may be predicted by a simple field-theoretic model, assuming the forces are due only to exchange of pions.
J.S.Bell

530.145

104. ENERGY LEVEL SHIFTS IN A LARGE ENCLOSURE. N.Fukuda and R.G.Newton.
Phys. Rev., Vol. 103, No. 5, 1558-64 (Sept. 1, 1956).

It is proved that for a particle enclosed in a large box, a potential shifts the energy levels by an amount which, as the volume v of the enclosure tends to infinity in a suitable manner, becomes proportional to $E^{1/2}\delta(E)v^{-1/3}$, where δ is the corresponding phase shift. Application of this result to the many-particle problem is discussed. A.

530.145

105. CALCULATION OF NUCLEON–NUCLEON SCATTERING FROM THE GARTENHAUS POTENTIALS. J.L.Gammel and R.M.Thaler.
Phys. Rev., Vol. 103, No. 6, 1874-6 (Sept. 15, 1956).

Nucleon–nucleon scattering and polarization are computed by using potentials calculated by Gartenhaus from the cutoff pseudoscalar symmetric meson theory proposed by Chew. The results are compared with experiment. A.

530.145

106. DISPERSION RELATIONS FOR FINITE MOMENTUM-TRANSFER PION–NUCLEON SCATTERING. R.H.Capps and G.Takeda.
Phys. Rev., Vol. 103, No. 6, 1877-96 (Sept. 15, 1956).

The field-theoretical derivation of dispersion relations for forward pion–nucleon scattering has been generalized to apply to the case of a fixed finite momentum transfer. The generalization is facilitated by use of the special Lorentz frame in which the sum of the momenta of the initial and final nucleons is zero. In this reference system the relations between dispersive and absorptive parts of the scattering amplitude are independent of momentum transfer and are similar in form to the forward-angle relations. At energies below the minimum energy necessary to allow a particular momentum transfer, the scattering amplitude has no direct physical meaning; it is interpreted as an analytic continuation of the physical amplitude to scattering angles corresponding to $\cos\theta < -1$. The resulting equations are expressed in terms of the amplitudes for individual angular momenta and are given in two forms, corresponding to the inclusion or neglect of nucleon recoil. A.

530.145

107. MAGNETIC EXCHANGE MOMENT TO ORDER eg^4 IN ADIABATIC APPROXIMATION. S.Hatano.
Progr. theor. Phys., Vol. 14, No. 2, 170-1 (Aug., 1955).

The magnetic exchange moment for two nucleons is calculated, by perturbation theory, for the static approximation, pseudo-scalar meson, symmetric vector coupling.
P.T.Matthews

530.145

108. DETERMINATION OF THE PION COUPLING CONSTANT IN NUCLEAR FORCES. J.Iwadare, S.Otsuki, R.Tamagaki and W.Watari.
Progr. theor. Phys., Vol. 15, No. 1, 86-8 (Jan., 1956).

Deuteron and low-energy scattering data are interpreted on the assumption that the one-pion-exchange potential of field theory is valid at large distances. It is concluded that $g_r^2/4\pi = 0.08 \pm 0.01$, where g_r is the renormalized coupling constant of the Ps.(pv.) theory. J.S.Bell

530.145

109. DYNAMIC DESCRIPTION OF SCATTERING BY TENSOR FORCES. J.M.Lozano.
Rev. Mexicana Fís., Vol. 4, No. 1, 13-22 (Jan., 1956). In Spanish.

Theoretical discussion of the description obtained for scattering by a short-range central potential (See Abstr. 2420/1955). This problem has the interest of being a simple example of a nuclear reaction with two channels, in which the scattering matrix is a meromorphic function of the wave number. J.J.Phipps

530.145

110. ON THE CONNECTION BETWEEN TRANSFORMATIONS IN CLASSICAL MECHANICS AND IN QUANTUM MECHANICS AND THE PHASE SPACE REPRESENTATION OF QUANTUM MECHANICS. U.Uhlhorn.
Ark. Fys., Vol. 11, Paper 4, 87-100 (1956).

Classical dynamics may be regarded as a theory of canonical transformations in the phase space, quantum dynamics as a theory of unitary transformations in the state-vector space. The transformation groups of classical and of quantum mechanics are not isomorphic but they contain subgroups which are isomorphic. The classical point transformations can also be represented by unitary transformations in the vector space A_1 (the set of complex-valued phase functions) and the corresponding quantum mechanical transformations can be represented by unitary transformations in the vector space A_2 (the set of linear operators in the state-vector space). According to the quantization prescriptions the vector spaces A_1 and A_2 are isomorphic and can thus be regarded as different representations of the same abstract vector space A. So far the choice of the unitary representations of the dynamical groups is rather ambiguous but if it is required that a certain subgroup should be common to both representations, the transformation connecting the vector spaces A_1 and A_2 is determined nearly completely. This makes it possible to obtain the group of transformations against which the quantization is invariant, and to treat quantum mechanical problems in "phase-space representation". A.

530.145

111. ON THE ENUMERATION OF THE EIGENVALUES OF THE SCHRÖDINGER EQUATION IN LIMITED REGIONS. T.Tietz.
Acta phys. Hungar., Vol. 5, No. 3, 347-52 (1955). In German.

A new method of counting the eigenvalues of a certain class of Schrödinger equations is outlined. The method depends on counting the number of zeros of the hypergeometric series ${}_1F_1$ and ${}_2F_1$ and may be used when the solution of the Schrödinger equation can be expressed in terms of one of these series. P.T.Landsberg

530.145

112. A PROBLEM OF STATIONARY STATES IN THE THEORY OF THE DOUBLE SOLUTION. A.Rot.
C.R. Acad. Sci. (Paris), Vol. 243, No. 5, 483-5 (July 30, 1956). In French.

A result of de Broglie, on the stationary states of a particle placed at the centre of a sphere, is extended to a particle placed arbitrarily in the sphere. J.S.Bell

530.145 : 548.7

113. A NOTE ON THE APPROXIMATION SOLUTION OF THE EQUATION $u''_{nl} + \frac{2}{r}u'_{nl} + \left[E_n - \frac{l(l+1)}{r^2} + V(r)\right]u_{nl} = 0$.

J.Koutecký.
Czech. J. Phys., Vol. 6, No. 2, 201-3 (April, 1956).

The method of calculating single electron wave-functions inside a crystal by applying the usual boundary conditions in the cellular method is discussed. The approximate solution is a superposition of two Bessel functions of whose orders are of the form $\pm(l + \frac{1}{2})$, where l is an integer. It is suggested that the coefficient of the Bessel function whose order is negative cannot necessarily by equated to zero. P.T.Landsberg

530.145

114. A REMARK ON THE PAPER BY J.KOUTECKÝ. E.Antončík and M.Trlifaj.
Czech. J. Phys., Vol. 6, No. 2, 203-4 (April, 1956).

It is suggested that in the approximate method discussed in the preceding paper (see preceding abstract), it is in fact necessary to retain only those solutions which are regular at the origin, so that the coefficient of the Bessel function whose order is negative must be equated to zero. P.T.Landsberg

530.145 : 539.152.1

115. GENERALIZATION OF THE METHOD OF SUPPLEMENTARY VARIABLES. D.N.Zubarev.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 489-92 (1956). In Russian.

Similarly to the treatment of plasma oscillations, coordinates describing collective motion, e.g. the charge, can be introduced quite generally into the Hamiltonian. Application to the A. Bohr model of the nucleus is indicated. G.E.Brown

530.145

116. WAVES IN A LATTICE OF SPHERICAL SCATTERERS. P.M.Morse.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 5, 276-86 (May, 1956).

A method of determining electronic wave functions by matching a central force solution, (appropriate to the atomic interior), to a plane-wave lattice solution, is outlined. The functions involved depend on either the spherical interior alone, or the lattice alone. Some of these have been computed and may be used to obtain graphical solution for specific cases. N.M.King

530.145

117. NOTE ON THE MANY-PARTICLE PROBLEM. C.R.Putnam.
Quart. appl. Math., Vol. 14, No. 1, 101-2 (April, 1956).

It is shown that the least point of the spectrum of the Hamiltonian, belonging to an atom with N electrons, atomic number Z, and a stationary nucleus, is in the point spectrum whenever $Z \geq 5N(N-1)/8$. P.T.Matthews

530.145

118. THE CORRELATION FUNCTION FOR QUANTUM MECHANICAL SYSTEMS. Yu.L.Klimontovich.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 977-9 (1956). In Russian.

The two-particle distribution in coordinates for a fluid can be written as the product of two single-particle distributions multiplied by a "correlation function". In the present note expressions for this function are listed and discussed but not derived. Expressions are given for fluids consisting of interacting bosons or fermions. Expressions for the two limits of full degeneracy and of classical statistics are explicitly written out. The quantum mechanical self-consistent field for an electron–ion plasma is discussed in connection with the equation determining the change in time of distribution functions. The field in the theory of electrolytes is shown to correspond to the classical limit of general self-consistent fields. R.Eisenschitz

530.162 : 530.145

119. ON A STOCHASTIC MODEL OF A CASCADE. K.Urbanik.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 3, No. 7, 349-51 (1955).

An abstract stochastic model of a cascade in which particles of one kind are destroyed. R.O.Davies

530.162 : 536.7

120. STATISTICAL MECHANICS OF IRREVERSIBLE PROCESSES. VII. BOLTZMANN EQUATION. R.Brout.
Physica, Vol. 22, No. 6, 509-24 (June, 1956).

For Pt VI see Abstr. 7168 (1956). A certain irreversible stochastic equation (called the "master equation") is obtained from the reversible equation of Liouville under the following hypotheses: (i) instantaneous collisions; (ii) infinite assembly; (iii) the initial distribution is that of a dilute gas, viz., no correlation in molecular positions outside a certain small range of influence (the "Stosszahlansatz"). It is shown that the Boltzmann equation follows from the master equation if the initial velocity distribution factorizes into single molecule distributions. It remains to be proved that this factorization does occur in the cases where Boltzmann's equation is normally used. R.O.Davies

530.162 : 536.7

121. STATISTICAL MECHANICS OF IRREVERSIBLE PROCESSES. VIII. GENERAL THEORY OF WEAKLY COUPLED SYSTEMS. R.Brout and I.Prigogine.
Physica, Vol. 22, No. 7, 621-36 (July, 1956).

A general theory of irreversibility in assemblies of weakly coupled systems whose Hamiltonian is of the form $H = \Sigma_i H_i + \lambda V$ ($|\lambda V| \ll \Sigma_i H_i$). The problems dealt with therefore include dilute gases and weakly anharmonic solids. The basic idea is that the phase space distribution function ρ can be written as a Fourier sum of eigenfunctions of the unperturbed Liouville operator corresponding to $H^0 \equiv \Sigma_i H_i$. This takes a very simple form in action-angle variables (J_i, α_i): $\rho = \Sigma_{\{n\}}\rho_{\{n\}}(J_1, \ldots J_N; t) \exp\{i\Sigma_i n_i(\alpha_i - \omega_i t)\}$ where ω_i are the frequencies $(\partial H^0/\partial J_i)$. The function $\rho_{\{0\}}$ has no phase correlation but the higher order amplitudes introduce phase correlation. In either case one can show under very general conditions that for an infinite system with $\lambda \to 0$, $t \to \infty$ ($\lambda^2 t$ finite) each amplitude $\rho_{\{n\}}$ obeys an equation of the first order in time. It is a remarkable fact that $\rho_{\{0\}}$ describes a Markoff process although $\rho_{\{n\}}$ ($n > 0$) does not. Certain consequences of the theory are investigated including an H-theorem, the treatment of macroscopic gradients and applications to phonon transport. R.O.Davies

530.162

122. STATISTICAL DYNAMICS OF MULTIPLY-PERIODIC SYSTEMS. M.Born and D.J.Hooton.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 2, 287-300 (1956).

For abstract, see Abstr. 96 (1956).

530.162

123. THE CONNECTION BETWEEN THE DISTRIBUTION OF A QUASI-MONOCHROMATIC STATIONARY PROCESS AND THE DISTRIBUTION OF ITS ENVELOPE. S.M.Rytov.
Zh. éksper. teor. Fiz., Vol. 29, No. 5 (11), 702-3 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 3, 571-2 (May, 1956).

A recent result of Blanc-Lapierre et al.(Abstr. 342B/1955, Ann. Télécomm., Vol. 9, No. 9, 237-45, Sept., 1954) is used to express the probability distribution of $\xi(t) = A\cos(\omega_0 t - \theta)$ directly in terms of that of the envelope A(t). R.A.Newing

530.162 : 536.7

124. THE RELATION BETWEEN OUR CRITERION OF STABILITY FOR A HOMOGENEOUS PHASE AND THAT OF S.V.TYABLIKOV. I.Z.Fisher.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 884 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 768-9 (July, 1956).

An acknowledgment of the close connection between an exact condition on the radial distribution function given by the author (Abstr. 5901/1955) and an approximate one due to Tyablikov (Zh. éksper. teor. Fiz., Vol. 17, 386, 1947). R.O.Davies

530.19

125. PHYSICAL REALIZABILITY CONDITIONS. M.K.Brachman and J.R.MacDonald.
Physica, Vol. 22, No. 8, 670 (Aug., 1956).

An answer to a recent criticism by Pelzer (Abstr. 7169/1956) of a statement by the authors (Abstr. 4133/1955) concerning the restrictiveness of the usual conditions for physical realizability, placed on the reduced polarization or the network function. G.D.Sims

GENERAL MECHANICS. MECHANICS OF SOLIDS 531

531.259

126. FINITE DEFORMATIONS II. E.J.Post.
Physica, Vol. 22, No. 8, 741-50 (Aug., 1956).

The strain series obtained in the previous part (Abstr. 3512/1956) is examined more closely and its correlation with previous expressions of finite strain is established. The results obtained suggest that a process, known as the process of dragging, is most suitable for a mathematical description of finite deformations. Its definition and properties are abstracted from current literature and briefly stated with special emphasis on physical applications. Some semi-novel applications are given pertaining to elasticity, anelasticity and electromagnetism. A.

531.653

127. THE KINETIC ENERGY OF RELATIVE MOTION. J.O.Hirschfelder and J.S.Dahler.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 6, 363-5 (June, 1956).

A particular set of (Cartesian) coordinates for a system of mass-points is defined which has the advantage of bringing the expression for total kinetic energy to an extremely simple form. R.Eisenschitz

MECHANICAL MEASUREMENTS 531.7

531.715

128. THE APPLICATION OF PNEUMATIC GAUGING TO HIGH PRECISION LINEAR MEASUREMENT. J.C.Evans and I.G.Morgan.
J. sci. Instrum., Vol. 33, No. 10, 388-90 (Oct., 1956).

Describes the application of pneumatic gauging to the precise measurement of the variation in thickness, in each of the three principal directions, of a nearly perfect cube recently used at the National Physical Laboratory in a new determination of the density of mercury by the principle of Archimedes. After discussing the theoretical basis of the method, the experimental arrangements are described and illustrated. It was established that the variations in thickness could be determined with an accuracy of $\pm 1 \times 10^{-6}$ in. ($\pm 0.025\mu$). Since one of the chief objects of the paper is to draw attention to some of the advantages of the pneumatic gauging technique for linear measurement, mention is made of other uses of the technique which demonstrate its comparative simplicity and wide flexibility. A.

531.717.1 : 539.165.08

129. BETA GAUGE FOR LOCALIZED MEASUREMENTS ON THIN FILMS. O.U.Anders and W.W.Meinke.
Rev. sci. Instrum., Vol. 27, No. 6, 416-7 (June, 1956).

Uses a narrow pencil of rays from a 5 mc Pm^{147} source mounted on a Lucite disk, a Lucite collimator and a thin-window G.M. tube. An exploded diagram shows details of the source and collimator assembly. The gauge was developed to determine the thickness of films used as cyclotron targets and is most sensitive for films up to 6 mg/cm^2. S.Weintroub

531.717.1 : 535.417

MODIFIED METHOD OF FIZEAU FRINGES FOR THICKNESS MEASUREMENTS. See Abstr. 290

531.717.7

130. CORRECTION TABLES FOR THE MEASUREMENT OF THE RADIUS OF CURVATURE OF PROOF GLASSES WITH THE RING SPHEROMETER. Z.Czerski.
Optik, Vol. 13, No. 8, 369-74 (1956). In German.

Numerical tables to assist in the rapid calculation for the cases considered by Jensen (Abstr. 1568/1955) and Schulz (Abstr. 5568/1952) are presented. S.Weintroub

531.752 : 681.26

131. THE DEVELOPMENT OF THE MICROBALANCE SINCE 1886. K.Behrndt.
Z. angew. Phys., Vol. 8, No. 9, 453-72 (Sept., 1956). In German.

A comprehensive review in which microbalances are divided into seven classes: (1) Microchemical and similar balances in which changes of load are balanced by changes of weights or of a rider; (2) Balances in which changes in load are balanced by changes in the buoyancy exerted on the balance by the atmosphere surrounding it; (3) Balances in which a variable restoring force is provided electrically or magnetically; (4) Torsion balances; (5) Balances in which the deflection of the beam is measured; (6) Balances consisting of a delicate cantilever deflected by the applied load; (7) Instruments in which the load is entirely supported by electrical or magnetic forces. Representative examples of these types of balance are described, the theory of some balances is outlined and references to methods of construction are given. Sources of errors and methods of calibration are considered and factors which influence the type of balance chosen for a given problem are discussed. Three tables summarize the applications of microbalances, examples of the different types and the range of sensitivity, from 10^{-5} to 10^{-9} g. There are 114 references up to 1956. A.H.Cook

531.787

132. A MINIATURE EIGHT-CHANNEL PRESSURE RECORDER. H.M.Nelson and G.A.Parker.
J. sci. Instrum., Vol. 33, No. 10, 383-5 (Oct., 1956).

A recorder is described which has been used for pressure plotting in free-flight models at supersonic speeds. The recorder can be fitted with any combination of pressure sensitive units with ranges of 0-10, 0-20 or 0-40 lb/in^2. Stylus-on-celluloid recording is used and the total duration of the record is about 40 sec. Overall accuracy under normal conditions of use approaches $\pm$ 1% of full-scale deflection. A.

MECHANICS OF FLUIDS 532

532.1

133. A USEFUL CORRELATION OF SOME PHYSICAL PROPERTIES OF LIQUIDS. M.H.Fraser.
Research Correspondence, Vol. 8, No. 11, S 57-S 58 (Nov., 1955).

To illustrate the applicability of the correlation $\eta^2 p^\alpha = \beta\gamma$ (η = viscosity; p = vapour pressure; γ = surface-tension; α, β = dimensionless constants) graphs of log (η^2/γ) against log p plotted for several organic compounds and mercury are given. S.Weintroub

532.13 : 534.23

134. VISCOSITY OF LIQUIDS AND ULTRASONIC STUDIES. A.K.Dutta, B.C.Ray and H.K.Rout.
Nature (London), Vol. 177, 1227-8 (June 30, 1956).

The number of spectral orders observed in very viscous liquids such as castor oil is very much less than the number observed for ordinary organic liquids of low viscosity. By elimination it is shown that this can be attributed to the larger damping of the quartz by the higher viscosity liquids. T.C.Toye

532.137

135. THEORY AND EXPERIMENTAL VERIFICATION OF THE OSCILLATING DISK METHOD FOR VISCOSITY MEASUREMENTS IN FLUIDS. P.Mariens and O.van Paemel.
Appl. sci. Res. A, Vol. 5, No. 5, 411-24 (1955).

A relation between the damping of a cylinder, suspended from a torsion wire and oscillating around its axis in an infinite viscous fluid, and the coefficient of viscosity of the latter has been deduced. For very thin disks and very weak damping, this relation is the same as that found by some other authors. The theoretical result has been checked by using it for absolute measurements in water, diethylether and air at ordinary temperatures, with disks and cylinders of different sizes, and by comparing the data with those obtained by means of other methods. The agreement proves to be good. A.

532.31 : 535.379

136. CHEMILUMINESCENCE AS A TOOL IN THE STUDY OF LIQUID FLOW BOUNDARIES. A.S.Friedman.
J. appl. Phys., Vol. 27, No. 4, 417 (April, 1956).

The "cold light" produced when a solution containing $K_3Fe(CN)_6$ and 3-aminophthalhydrazide interacts with an alkaline solution of H_2O_2 renders the flow pattern boundary easily seen when the former solution streams from a nozzle into the latter. W.Good

532.570.8

137. SQUARE-WAVE ELECTROMAGNETIC FLOWMETER DESIGN. A.B.Denison, Jr and M.P.Spencer.
Rev. sci. Instrum., Vol. 27, No. 9, 707-11 (Sept., 1956).

The square-wave principle for electromagnetic flow recording offers several theoretical advantages over the d.c. or a.c. systems, particularly for blood flow recording from intact vessels. The degree to which these advantages may be obtained in practice depends upon the extent to which the equipment meets the specific requirements of the principle. This paper considers the objectives that should be considered in design and construction of a practical equipment. A.

532.582.3

138. NOTE ON THE DRAG ON A CIRCULAR CYLINDER MOVING WITH LOW SPEEDS IN A SEMI-INFINITE VISCOUS LIQUID BOUNDED BY A PLANE WALL. Y.Takaisi.
J. Phys. Soc. Japan, Vol. 11, No. 9, 1004-8 (Sept., 1956).

The steady slow motion of a circular cylinder in a semi-infinite viscous liquid bounded by a plane wall is discussed on the basis of Stokes' equations of motion, assuming that the cylinder is moving parallel to the bounding wall. It is shown that the components of velocity satisfying the boundary conditions on the bounding plane wall as well as at the surface of the cylinder, satisfy also automatically the conditions at infinity. A second approximation for the drag on the circular cylinder is obtained. As far as higher-order terms are neglected, it is in perfect agreement with the first approximation obtained recently by the present writer on the basis of Oseen's linearized equations of motion. A.

532.582.3

139. NOTE ON THE DRAG ON A CIRCULAR CYLINDER MOVING WITH LOW SPEEDS IN A VISCOUS LIQUID BETWEEN TWO PARALLEL WALLS. Y.Takaisi.
J. Phys. Soc. Japan, Vol. 11, No. 9, 1009-13 (Sept., 1956).

The steady slow motion of a circular cylinder in a viscous liquid bounded by two parallel plane walls is discussed on the basis of Stokes' equations of motion, considering only the case when the cylinder is moving midway between the bounding walls. A second approximation for the drag experienced by the cylinder is then calculated and compared with White's experiments. But the disagreement existing between the first approximation obtained recently by the present writer on the basis of Oseen's linearized equations of motion and White's empirical formula, when the values of the ratio (distance between the walls/diameter of the cylinder) are small than 20, has hardly been removed. As far as higher-order terms are neglected, the second approximation is in perfect agreement with the first approximation. A.

532.59 : 519.2

140. STATISTICAL PROPERTIES OF A MOVING WAVE-FORM. M.S.Longuet-Higgins.
Proc. Cambridge Phil. Soc., Vol. 52, Pt 2, 234-45 (1956).

This paper considers certain properties of a stochastic, one-dimensional disturbance whose space part forms a Gaussian random process and whose time part is linked to the space waves by a given frequency function: $f(x, t) = \Sigma_k c(k) \cos [kx + \omega(k)t + \phi(k)]$, with $c(k)$ Gaussian and $\phi(k)$ uniformly distributed. Using the methods of Rice, distributions are obtained for the velocity of zeros and the velocity of points of given slope. The appearance and disappearance of such points is also considered. For the case of points of given slope this is called "twinkling" because it is seen directly when a light is observed after reflection from a disturbed water surface. Under certain conditions it is possible to get information about the direction and amplitude of waves by observing "twinkles" from various angles. R.O.Davies

532.59 : 535.557

DOUBLE REFRACTION OF A LIQUID IN A DYNAMIC FIELD OF DISPLACEMENT WAVES. See Abstr. 300

CAPILLARITY 532.6

532.61.08

141. MEASUREMENT OF SURFACE TENSION BY UNSTABLE PENDANT DROPS. N.R.Tawde and K.G.Parvatikar.
Indian J. Phys., Vol. 30, No. 7, 348-52 (July, 1956).

A workable experimental technique has been evolved to subject the unstable pendant drops to surface tension measurements, utilizing the expression derived earlier. The values calculated from the expression by the use of observed data on three liquids compare favourably with the known constants on surface tension. A.

532.61 : 536.7

142. THERMODYNAMICAL FUNDAMENTAL EQUATION FOR SPHERICAL INTERFACE. S.Kondo.
J. chem. Phys., Vol. 25, No. 4, 662-9 (Oct., 1956).

The relation between the radius of the Gibbs dividing surface and the superficial density is investigated in detail and the generalized Kelvin relation is obtained. Consequently the fundamental equation for the spherical interface is expressed by $dE = TdS + \mu dN - p_\alpha dV_\alpha - p_\beta dV_\beta + \gamma dA + (\partial\gamma/\partial a)Ada$. The generalized Kelvin relation is the explicit differential equation for determining the location of the surface of tension which does not contradict with the conventional one. Thus the mathematical formalism of thermodynamics is completed for treating the spherical interface in a rigorous and self-consistent manner, the last ambiguous point being eliminated from the conventional Gibbs treatments. A.

532.612.4

143. TEMPERATURE VARIATION OF SURFACE TENSION AS A FREE VOLUME PROBLEM. S.S.Mitra and D.N.Chakravarty.
Naturwissenschaften, Vol. 43, No. 12, 273 (1956).

Starting from an unpublished formula by S.S.Mitra, $S = (C/V_f)^{n/3}$ (where S = surface tension, V_f = free volume, C and n are constants), and using Eyring's formula, $V_f = (CRT/\Delta_{evap})^3 V$ (V = molar volume, Δ_{evap} = energy of vaporization, C the packing factor being considered constant), and making a few simplifying assumptions, the authors arrive at the simple formula $S = (\alpha/T - \beta)^n$. Further, since S tends to vanish near the critical region, the last equation becomes $S = C[(Tc - T)/T]^n$, where C and n are constants and Tc the critical temperature. Good agreement with empirical results is found for a number of liquids. T.C.Toye

532.612.4 : 536.48

SURFACE TENSION OF LIQUID He^4 AND LIQUID He^3. See Abstr. 325

MOLECULAR THEORY OF LIQUIDS 532.7

532.7 : 541.57

144. ENERGY OF THE B–O BOND AND THE STRUCTURE OF LIQUID BORON TRIOXIDE. J.D.Mackenzie.
J. chem. Phys., Vol. 25, No. 1, 187-8 (July, 1956).

Consideration of available evidence indicates that, whereas liquid SiO_2 possesses a structure similar to that in the solid, such is not the case for B_2O_3. The only structure possible consistent with viscosity results and the accepted value of the B—O bond energy requires closer packing and a density—temperature relation giving greater than linear increase of density with increasing temperature. The experimental evidence of Shantsis (Journal of the American Ceramic Society, Vol. 36, 35, 1953) is quoted in support of the hypothesis. T.C.Toye.

532.7

145. INTERATOMIC POTENTIAL FUNCTIONS OF SODIUM AND POTASSIUM. R.C.Ling.
J. chem Phys., Vol. 25, No. 4, 609-13 (Oct., 1956).

The liquid structure theory of Born and Green is used to interpret X-ray diffraction measurements on liquid sodium and potassium to find an effective interatomic potential function for pairs of sodium and pairs of potassium atoms. This potential function predicts approximately the correct binding energy for solid sodium and potassium, and when reinserted in the X-ray formulae predicts scattering curves at higher temperatures which are in good agreement with experiments. A.

532.7 : 535.43 : 537.531

146. X-RAY SCATTERING BY LIQUID-METAL ALLOYS (A KINETIC APPROACH). R.C.Ling.
J. chem. Phys., Vol. 25, No. 4, 614-16 (Oct., 1956).

The Born—Green theory of liquids is extended to the case of liquid mixtures, and a formula for the X-ray scattering by such liquids is developed. The formula is used to calculate the X-ray scattering by a liquid sodium—potassium alloy, and fair agreement with the experimental scattering is found. A.

532.7

147. APPLICATION OF CELL THEORY TO LIQUID HYDROCARBONS. R.Simha and S.T.Hadden.
J. chem. Phys., Vol. 25, No. 4, 702-9 (Oct., 1956).

The cell theory in the formulation of Prigogine, Trappeniers and Mathot and their assumptions are examined. The molecular volumes of n-paraffins of high molecular weight are well represented in terms of an energy and volume parameter characteristic of the repeating unit. Fairly good agreement for branched systems is also found on making the proper modifications in the equation of state. The resulting low temperature heats of vaporization seem reasonable. One can show that the theory leads to the Kurtz—Lipkin—Sankin relations and interprets, so far, for paraffins their K_1 and K_3. Isotherms up to about 1000 bar can be represented fairly satisfactorily, 80-90% of the total compression observed being accounted for. This applies to n-paraffins as well as polyethylene and, in a semiempirical manner, to polystyrene. The physical significance of the constants in the emprical Tait equation is explored. For large chain-lengths C is a pure numeric and independent of structure and molecular weight, in qualitative conformity with experimental results. B is related to the ratio of characteristic energy and volume of the submolecule, or to the above parameter K_1. These results argue in favour of extensing the theory, so as to permit handling of a wider range of variables, and other types of molecules. A.

532.7

148. RELATION BETWEEN THE VOLUME OF A LIQUID AND ITS INTERNAL ENERGY. M.B.King and R.F.Strickland-Constable.
Nature (London), Vol. 178, 275 (Aug. 4, 1956).

The Boltzmann—Van der Waals type of potential energy, $E \propto 1/V^2$, is obtainable from a model in which the expansion of a liquid is due to "holes" appearing in the first co-ordination shell. R.O.Davies

532.71 : 541.135

149. A NOTE ON THE STUDY OF ELECTRO-OSMOSIS WITHOUT A FILTER MEDIUM. L.H.Collet.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 266-9 (July 16, 1956). In French.

The author sets out to show the part played in electro-osmosis by the ionized solvent. Two platinum foil electrodes are suspended in double-distilled water and a potential of 300 V is applied to them. The electrode assembly makes a slight movement in the direction of cathode towards anode. A modification to the electrode assembly allows it to move freely on the surface of the liquid. It is found that (1) the rate of movement of the electrode assembly is proportional to the current flowing and (2) the rate falls very rapidly when the concentration of the solution increases. W.A.Walker

532.712

150. OSMOTIC PRESSURE PHENOMENA AS OBSERVED IN SILVER MEMBRANE OSMOMETERS. T.A.Barr.
J. chem. Phys., Vol. 25, No. 4, 669-73 (Oct., 1956).

Two features of aqueous polyethylene glycol solutions (molecular weights 285 to 6600) have been noted in experiments with silver membrane osmometers: first, the solutions can be forced through the membranes in a manner which is indicative of capillary viscous flow; second, the osmotic pressures of polyethylene glycols are such that the limits of the reduced osmotic pressure as the concentration tends towards zero are of the form KM^{α}, when K and α are positive numbers, instead of RT/M as is indicated by thermodynamic theory. The differences between theoretical and observed osmotic pressures are interpreted as being due to diffusion of solute through the membranes. On this basis diffusion coefficients are calculated for the diffusion of polyethylene glycol through the membranes. For an estimated molecular weight of 400 000 the membranes are semipermeable. Similar work has been done on polystyrenes (molecular weights 180 000 to 673 000) and the membranes are shown to be semipermeable for polystyrenes of molecular weights greater than 500 000. A.

532.72

151. THE STATIONARY THERMO-ELECTRIC POTENTIAL IN IONIC SOLUTIONS IN SORET EQUILIBRIUM. J.Chanu.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 239-41 (July 16, 1956). In French.

The application of the thermodynamics of irreversible processes, based on the reciprocal relations of Onsager, to the study of thermal diffusion in ionic solutions, leads to phenomenological relations on the existence of an electrical potential gradient which appears with the gradients of concentration and of temperature. Comparison is made with the author's experimental results. H.C.Cole

532.73 : 541.64

152. THEORY OF DILUTE HIGH POLYMER SOLUTIONS (THE PEARL NECKLACE MODEL). A.Isihara and R.Koyama.
J. chem. Phys., Vol. 25, No. 4, 712-16 (Oct., 1956).

A theoretical expression for the second virial coefficient A_2 of chain polymer solutions is derived. This accounts for the empirical relation between A_2 and molecular weight M, according to which A_2 is proportional to $M^{-\alpha}$. α has a value of about 0.23 over a suitable range of molecular weight. According to the theory, $\alpha \cong \frac{1}{2} - \frac{3}{4}(\log 1.684x)$, when x, a variable proportional to the square root of M, becomes very large. The temperature variation of A_2 is also explained. Krigbaum and Flory's data on the molecular weight and temperature dependence of A_2 are discussed. A.

532.73 : 541.64

153. ELEMENTS OF THE THERMODYNAMIC THEORY OF MACROMOLECULE POLYELECTROLYTES. I. SCALAR THEORY OF MACROMOLECULES IN DILUTE SOLUTION. C.Marmasse.
J. Chim. phys., Vol. 53, No. 6, 501-5 (June, 1956). In French.

For a rigid polymer, taking account of its geometry. The process of ionization and the thermodynamic functions are considered from the elementary processes involved, using a generalized charge distribution function. A statistical model is proposed for the solution in accordance with its electrical properties, and the approximate potential at a given point in the solution is derived. The theory will be extended to flexible polymers. G.Allen

MECHANICS OF GASES 533

533.15 : 539.217.1

154. SURFACE DIFFUSION AND THERMAL TRANSPIRATION IN FINE TUBES AND PORES. T.L.Hill.
J. chem. Phys., Vol. 25, No. 4, 730-5 (Oct., 1956).

The role of surface transport in the passage of a gas at

low pressure through fine tubes or pores is examined in terms of simple models of mobile and localized adsorption. The amount of surface transport becomes about equal to the amount of gas transport when the tubes or pores have radii of the order of several hundred Angstrom units. The theory predicts that surface transport will have little effect on the pressure gradient across the tube or pores in the absence of a temperature gradient. But the pressure gradient should be increased considerably, as a result of surface transport, over the usual (thermal transpiration) pressure gradient when there is a temperature gradient across the tube or pores. A.

533.15

155. USE OF NICKEL DIFFUSION TUBES FOR THE PURIFICATION OF HYDROGEN. L.C.W.Hobbis and E.R.Harrison.
Rev. sci. Instrum., Vol. 27, No. 4, 238 (April, 1956).

In reply to criticism by, Juenker, van Swaay and Birchenall (Abstr. 8621/1956) on the authors' objections (1955) to the use of palladium for the purification of hydrogen, a case is put forward to show the superiority of nickel over palladium for this application. It is claimed that nickel will give a consistent and reproducible performance over long periods of time without any special treatment. The smaller diffusion rate of hydrogen through nickel is also considered to be an advantage inasmuch as the larger surface area required may be obtained by using long tubes of small diameter which can be conveniently heated directly from a mains transformer. The effect of silver solder on palladium is discussed; here again nickel is considered to be superior to palladium.

H.C.Cole

533.16

156. DETERMINATION OF THE VISCOSITY OF NITROGEN COMPRESSED UP TO 3000 kg/cm^2. F.Lazarre and B.Vodar.
C.R. Acad. Sci. (Paris), Vol. 243, No. 5, 487-9 (July 30, 1956). In French.

The viscosity is measured by the flow through a capillary tube. By means of an electromagnetic plunger immersed in mercury a pressure difference can be set up and the flow rate is determined by timing the passage of the mercury meniscus past a series of electrical contacts. Measurements were made at 25°C, 50°C and 75°C with an overall accuracy of the order of 1%. F.Ansbacher

533.5 : 531.788.7 : 536.655

157. A RADIOACTIVE IONIZATION GAUGE AND ITS APPLICATION TO THE MEASUREMENT OF LATENT HEAT OF VAPORIZATION. J.H.Beynon and G.R.Nicholson.
J. sci. Instrum., Vol. 33, No. 10, 376-80 (Oct., 1956).

A radioactive ionization gauge useful in the range of pressures 10^{-5} to 10 mm of mercury, and its application to the determination of the latent heat of vaporization or sublimation of organic compounds having vapour pressures in the above range up to 200°C, are described. The instrument uses a 0.5 mc sealed radium source for ionization of the vapour and an electrometer amplifier for measuring the ionization currents produced. Values for the latent heats of fourteen compounds are given. A.

533.5 : 531.778.7

158. ABSOLUTE PRESSURE DETERMINATION USING THE IONIZATION GAUGE. R.P.Henry.
Vide, Vol. 11, 54-65 (March-April, 1956). In French.

The method of Oatley for the determination of the speed of a pump system (Abstr. 10883/1954) is combined with an accurate measurement of the gas flow at exit to the atmosphere, to effect a measurement of pressure. This is a consequence of the fact that (pressure x throughput) is an invariant. The ionization gauge is assumed to have a linear law but the gauge constant does not appear in the result. A very complete description of the experimental technique and full tables of results, showing a high precision are given. A.H.W.Beck

533.5

159. SOME THEORETICAL AND EXPERIMENTAL OBSERVATIONS ON THE ULTIMATE VACUUM OBTAINABLE IN VAPOUR PUMPS. N.A.Florescu.
Vacuum, Vol. 4, No. 1, 30-9 (Jan., 1954; publ. June, 1956).

A criticism is advanced of the assertion still current, that the ultimate vacuum of a vapour pump is limited by the diffusion of gas back through the vapour blast. With an experimental device it has been shown that the ultimate vacuum with hydrogen is much lower than that resulting from backward diffusion. The occurrence of the gas escaping back through the vapour molecules, particularly in the case of hydrogen, has been proved and it has been shown that vapour condensation is not required for pumping action. It has been confirmed that the ultimate vacuum is limited by the presence of gases in the vapour stream from the boiler. From curves showing the variation of the ultimate vacuum with the fore pressure it is possible to distinguish between the prevalence of the gas escaping backward and the gas contained in the vapour. A.

533.5

160. THE ULTIMATE VACUA OF TWO-STAGE ROTARY OIL PUMPS. D.A.Hockly and C.S.Bull.
Vacuum, Vol. 4, No. 1, 40-7 (Jan., 1954; publ. June, 1956).

It had been noticed that rotary pumps show an increased ultimate pressure as their temperatures rise during operation. It is established that this pressure rise is not due to the presence of vapours of the oil used in the pump itself but possibly to the progressive appearance of vapours from the lighter fractions of the oil liberated as a result of decomposition. It is concluded that this phenomenon resulted from the thermal effects of the vanes sliding in the rotor where the condition of boundary lubrication exists. Extreme-pressure additives to the oil had a marked influence on these pressure variations and it may be possible to discover an additive which will completely prevent the cracking of the oil. A.

533.6.011.3

161. THE FLOW DUE TO IMPULSIVE MOTION OF A WEDGE. II. A.Sakurai.
J. Phys. Soc. Japan, Vol. 11, No. 9, 987-93 (Sept., 1956).

As a continuation of the previous study on the impulsive motion of an advancing wedge (Abstr. 3497/1955) the case is now considered in which the wedge is receding. The general features of both cases are similar, but there are now rarefaction waves instead of the shock waves which played a fundamental role in the previous paper. The two limiting cases of small, and almost blunt, vertex angles are discussed analytically. The former is essentially the same as the corresponding case of the advancing wedge. On the other hand, the latter presents new features. A.

533.6.011.31 : 532.65

162. THE VELOCITY OF FREE FALLING DROPLETS. P.Van Der Leeden, Liem Djan Nio and P.C.Suratman.
Appl. sci. Res. A, Vol. 5, No. 5, 338-48 (1955).

The velocity of free fall of droplets of various liquids and for several sizes has been determined as a function of the height of fall. The results are discussed in connection with Reynold's and Weber's numbers. The drag coefficients found are independent of Re and a unique function of We. The C_d-We-curve shows a discontinuity at We $\cong$ 5. A.

533.6.011.311

163. MEASUREMENT OF WALL SHEARING STRESS IN THE BOUNDARY LAYER BY MEANS OF AN EVAPORATING LIQUID FILM. J.S.Murphy and A.M.O.Smith.
J. appl. Phys., Vol. 27, No. 9, 1097-103 (Sept., 1956).

A mass transfer method for measurement of local wall shear stress in laminar and turbulent flow is presented. A thin film of a suitable fluid is coated on the model surface and evaporation rate determined from film thickness measurements using light interference fringes. Application of the method to wall stress measurements in flat plate flow is presented and shows good correlation with theory. In the present state of development, the technique may be used for determining the shear stress distribution over a surface relative to the value at some reference station. The absolute magnitude of the shear stress at the reference station must be found by another method. In this respect the mass transfer method is similar to the interferometric method of measuring density distribution in high-speed flows. A.

533.6.011.5

164. STUDY OF SHOCK WAVES BY LIGHT ABSORPTION AND EMISSION. H.B.Palmer.
J. appl. Phys., Vol. 27, No. 9, 1105-6 (Sept., 1956).

Observations made while studying the rate of dissociation of bromine at high temperature by shock waves generated in a 1 in. diameter glass tube containing a 10-fold excess of argon

mixed with bromine vapour are reported. Equilibrium absorption was found to be much larger than that predicted from equilibrium calculations. A rough value of the thickness of the boundary layer along the tube wall behind the shock front was obtained, and showed that the properties of the gas in the shock interior agree well with those calculated from the shock-front velocity and the Rankine–Hugoniot relations. J.D.G.Thomas

MOLECULAR THEORY OF GASES 533.7

533.7 : 536.7

165. MEASUREMENTS ON THE SECOND VIRIAL COEFFICIENT OF NITROGEN BETWEEN 90 AND 65°K WITH USE OF ULTRASONICS. A.van Itterbeek, H.Lambert and G.Forrez.
Appl. sci. Res. A, Vol. 6, No. 1, 15-20 (1956).

An indirect method, based on the velocity of sound as a function of pressure, is used. An equation for this coefficient as a function of temperature is derived. This equation is valid between 65° and 150°K. Also above 150°K good agreement is found with the values obtained by Kamerlingh Onnes and van Urk. Using a Lennard-Jones potential the second virial coefficient was calculated by Hirschfelder's method. Agreement with experiment was good. A.

533.7

166. A NEW METHOD FOR DETERMINING THE SECOND VIRIAL COEFFICIENT OF A GAS. H.M.Ashton and E.E.Guggenheim.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 693-4 (June, 1956).

It is pointed out that, since the second "refractivity virial coefficient" is negligibly small compared with the second virial coefficient (B), values of B can be obtained from measurements of the refractive index and the pressure, without any need for density measurements. The procedure has been applied to ethylene and neopentane. E.H.Sondheimer

533.7

167. DISTRIBUTION FUNCTION OF A NON-IDEAL BOSE GAS AT THE TEMPERATURE OF ABSOLUTE ZERO. D.N.Zubarev.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 881-2 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 745-6 (July, 1956).

A new calculation of the momentum distribution at absolute zero in terms of the Fourier coefficients of the radial distribution function. The results confirm earlier work by Bogolyubov (Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 11, 77, 1947). R.O.Davies

533.7 : 539.156

ENERGY OF INTERACTION BETWEEN A HYDROGEN ATOM AND A HELIUM ATOM. See Abstr. 642

VIBRATIONS. ACOUSTICS 534

534.01

168. POSSIBILITY OF FREE OSCILLATIONS IN A VARIABLE-PARAMETER RESONANT SYSTEM. E.Cambi.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 2, 137-81 (1956).

A somewhat detailed analytical review of oscillations in a physical system. The discussion is confined to variable systems which obey a second-order linear equation of the form $L(d^2y/dt^2) + R(dy/dt) + y/C = 0$ where only one of the coefficients L, R, C is a function of t and the variation is sinusoidal with a relative modulation < 1, i.e. the variable coefficient is of the form $M(1 + 2\gamma \cos \mu t)$ with $2\gamma \leq 1$. The reduction to the Hill equation and its limiting case, the Mathieu equation, are considered. The stability and lability of the solutions and the regions of physical interest are discussed. The case where the coefficient undergoes discontinuous periodic variations is also considered. S.Weintroub

534.115

169. UNEXPECTED WAVES OBSERVED IN FLUID-FILLED BORE HOLES. J.E.White and H.H.Frost.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 924-7 (Sept., 1956).

Measurements of pressure and particle velocity in fluid-filled bore holes have yielded several unexpected results, some of which can be explained by very simple computations. One is an acoustic square-wave, a flat-topped pulse which is generated when a slug of water, broken off from the main column by cavitation, rejoins the column. In another instance, the geometry is such that a wave along a steel casing is the first signal to arrive at a pressure detector, and the initial pressure is negative, although the explosive pressure generating the transient is initially positive. The manner in which a steel casing causes a reversal of pressure in the "casing break" is described. An expression is also presented which relates the negative pressure observed at the bottom of an uncased well to the elastic constants of the fluid and solid. As a fourth example, initial upward motion of a geophone hanging in a bore hole is shown to be consistent with the circumstances under which the observations were made. A.

534.133

170. HIGHER MODES OF RADIAL VIBRATIONS IN SHORT, HOLLOW CYLINDERS OF BARIUM TITANATE. C.V.Stephenson.
J.Acoust. Soc. Amer., Vol. 28, No. 5, 928-9 (Sept., 1956).

Discusses the forbidden and allowed modes of radial vibrations. Theoretically, for a given ratio of outside diameter to inside diameter, it is possible to predict which of these higher modes will be observed. The theory has been checked experimentally and, within the limits of the experiment, has been found to be true. A.

534.141.4

171. ON THE FREQUENCY OF SOUND WAVES EMITTED BY A HIGH SPEED JET OF AIR. M.Merle.
C.R. Acad. Sci. (Paris), Vol. 243, No. 5, 490-3 (July 30, 1956). In French.

Jets of revolution (4, 6, 8 and 14 mm diameter) operated at pressures of the order 7 kg/cm² emit sound waves in which the distribution of frequency appears in 5 successive stages of unequal stability. These different domains are attributable to the periodic structure of the jet. If, however, the jet is bi-dimensional (issuing from a more or less flattened slit orifice) this discontinuity of frequency does not exist. When square jets (in the form of a truncated pyramid) are used, two stages have been observed, the frequency of the square jet being higher than that of the corresponding bi-dimensional (slit) jet. A.B.Wood

534.141.4

172. VORTEX-RING STRUCTURE-TRANSITION IN A JET EMITTING DISCRETE ACOUSTIC FREQUENCIES. A.B.C.Anderson.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 914-21 (Sept., 1956).

Visualization of the vortex flow pattern in typical jets emitting jet tones was made by means of shadowgraph techniques to show the nature of the ever-present process of vortex coalescence in the jet and how this determines the values of the eigenton sound frequencies radiated by the jet. These frequencies are super-imposed on the noise background radiated by the jet. The dependence of: (a) vortex shedding frequency from the orifice; (b) jet-tone frequencies, and (c) translational velocity of the vortices on Reynolds number (Re) is shown. These studies were carried out with carbon dioxide jets discharging into the atmosphere. The flow channel geometry consisted of an orifice plate containing a sharp-edged, circular orifice, 0.250 in. in diameter and 0.093 in. thick attached to a large stilling tank partly filled with sound-absorbing material to eliminate any effects of cavity resonance on the jet. The studies were carried out over the range from Re zero to Re 7000, where $Re = v\rho t/\mu$ and v is mean velocity of discharge of jet; ρ, gas density; t, orifice plate thickness, and μ, gas viscosity. A.

534.2

173. SCATTERING OF A PLANE LONGITUDINAL WAVE BY A SPHERICAL OBSTACLE IN AN ISOTROPICALLY ELASTIC SOLID. C.F.Ying and R.Truell.
J. appl. Phys., Vol. 27, No. 9, 1086-97 (Sept., 1956).

Scattering by a spherical obstacle of a plane longitudinal wave propagating in an isotropically elastic solid is computed. Expressions for the scattered wave and the total scattered energy are given. Three special types of obstacle — an isotropically elastic sphere, a spherical cavity, and a rigid

sphere — are discussed in detail, especially for Rayleigh scattering. The result for the isotropically elastic sphere is compared with the well-known result of scattering of a plane wave propagating in an ideal fluid by a sphere of another ideal fluid. A.

534.21

174. SUCCESSFUL METHOD OF ATTACK ON PLANE PROGRESSIVE FINITE WAVES. R.D.Fay.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 910-14 (Sept., 1956).

The characteristic feature of the method is that at any point in the sound field the conservation criteria are expressed in terms of the instantaneous values of the speed of propagation, the particle velocity, the excess pressure, and excess density. These criteria, together with the adiabatic assumption, determine explicit relations between any two of these quantities. Excess pressure and excess densities are here defined as departures from the equilibrium values that exist at the instant when the particle velocity is zero. For waves of finite amplitude these equilibrium values, as well as the speed of propagation, are found to depend on the intensity. The increment in the speed of propagation does not agree with that obtained by classical methods of analysis. The discrepancy is found to be due to the omission in the classical forms of the continuity criterion of a term that specifies the effect of the rate of change in the speed of propagation. A.

534.213 : 548.7

175. ON THE PROPAGATION OF ACOUSTIC WAVES IN CRYSTALS. R.Bingen.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 41, No. 7, 741-58 (1955). In French.

The equations of motion, giving the displacement and velocity of each particle in the lattice, can be written in a simple form, using certain "influence functions". These are triple integrals, which can be calculated exactly only when the spectrum of normal frequencies is known, the asymptotic values of which (for large t) however have some properties independent of the exact frequency spectrum, these properties being of importance in the study of irreversible processes in the crystal. To evaluate the asymptotic values, the propagation of a disturbance starting from the origin is studied. The wave is dispersed and its amplitude decreases as $t^{-4/3}$, while the wavefront spreads out as $t^{1/3}$. On account of the existence of some normal frequencies for which the group velocity is very small or even zero, the disturbance does not die out completely even after the lapse of a long time, but subsists as an oscillation with an amplitude proportional to $t^{-3/2}$. It is shown that the movement of each lattice point is only influenced by the initial conditions of a small number of neighbouring points. These are particles situated inside the wavefront of the disturbance which would have been produced at the point considered at the time t = O. T.P.Brody

534.22

176. EXPERIMENTAL STUDY OF THE PROPAGATION OF ULTRASONICS IN FLUIDS AS A FUNCTION OF PRESSURE (1200 ATM) AND OF TEMPERATURE (200°C). A.Lacam.
J. Rech. Cent. Nat. Rech. Sci., No. 34, 25-56 (March, 1956). In French.

An interference method has been developed for the measurement of ultrasonic velocity in fluids at high pressures and temperatures. The frequency range is from 2 to 5 Mc/s and the estimated ultrasonic power used approximately 0.3 W. The velocities at various temperatures and pressures are given for argon, nitrogen, methane, and propane, while in each case the adiabatic compressibilities and ratios of specific heats are calculated from the observed velocities. The plots of γ with increasing pressure in each case show excellently defined maxima at all temperatures. No information on relaxation processes could be found however. T.C.Toye

534.22 : 532.7

177. ULTRASONIC VELOCITY IN IODIC ACID SOLUTIONS BY OPTICAL DIFFRACTION METHOD. J.R.Saraf and L.N.Srivastava.
Z. phys. Chem. (Leipzig), Vol. 205, No. 1-2, 84-90 (Oct., 1955).

The investigations show the existence of discontinuities below 0.1N; other properties show discontinuities at 0.09N, and 0.04N but these ultrasonic velocity measurements indicate that another discontinuity should exist at 0.03N. The fact that ultrasonic velocity is a molecular property adds weight to the assumption that the discontinuities are attributable to transitions from one type of molecule to another. T.C.Toye

534.22.093.3

178. THE CONCENTRATION DEPENDENCE OF SOUND VELOCITY IN POLAR–NONPOLAR MIXTURES AT DIFFERING CHAIN LENGTHS. K.Rehfeld.
Z. phys. Chem. (Leipzig), Vol. 205, No. 1-2, 78-83 (Oct., 1955). In German.

It is found that the minimum in velocity–concentration curve moves towards zero dipole concentration with increasing chain length. T.C.Tove

534.222.2 : 523.11

179. SHOCK WAVES IN STEADY RADIAL MOTION UNDER GRAVITY. W.H.McCrea.
Astrophys. J., Vol. 124, No. 2, 461-8 (Sept., 1956).

In the steady radial flow of a polytropic gas toward a centre of gravitational attraction, it is shown that a standing shock wave can, in general, exist within a certain distance of the centre. This possibility elucidates certain features of Bondi's investigation of such radial motion and, in particular, helps to resolve an indeterminacy which he had noted. Reasons are given for concluding that the phenomenon may have application to accretion by a binary star. A.

534.222.2 : 539.4

180. SAWTOOTH SHOCK AS A COMPONENT TEST. C.T.Morrow and H.I.Sargeant.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 959-65 (Sept., 1956).

The shock effect of a terminal-peak sawtooth of acceleration obtained by a drop on to a lead pellet has been investigated experimentally using the shock spectrum as the criterion of severity. It is shown that this spectrum obtained by analysis of the acceleration–time data can be made to approximate closely over a wide frequency range that obtained theoretically for an ideal sawtooth. The smoothness of the spectrum which results from the extreme asymmetry of the pulse shape makes the sawtooth a particularly attractive standard pulse-shape for shock test in the laboratory. A.

534.23 : 537.312.62

181. ULTRASONIC ATTENUATION AT LOW TEMPERATURES FOR METALS IN THE NORMAL AND SUPERCONDUCTING STATES. W.P.Mason and H.E.Bömmel.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 930-43 (Sept., 1956).

At very low temperatures the mean free paths of electrons in metals become so large with respect to their values at room temperature that they can acquire momentum from collisions with lattice vibrations which result in ultrasonic attenuation when the electrons are in the normal state. This attenuation drops to zero in the superconducting state. Original measurements in impure lead, tin and copper showed an attenuation proportional to the square of the frequency which could be directly related to the electron viscosity calculated from the number N, the mass m, the mean free path $\bar{l}$ and the mean velocity $\bar{v}$ of the electrons. Recently some very pure tin samples have been obtained and much larger effects have been measured due to the increased conductivity at low temperatures. Six oriented samples have been measured and from the measurements the six elastic constants and six viscosity coefficients have been obtained. These correspond to those for a tetragonal crystal. As the mean free path becomes longer than the acoustic wavelength, the loss is determined by a scattering process and the loss for a given frequency approaches a limiting value in agreement with a theoretical prediction of Pippard. The loss for longitudinal waves is from 2.5 to 7.5 times the predicted value while that for shear waves is about 1.5 times the theoretical value of Pippard's. Measurements of the elastic constants have been made through the superconducting range and the only discontinuity that occurs is that due to the thermodynamically predicted value. The change for a longitudinal wave is less than that predicted for a volume change in agreement with a theoretical derivation. No relaxtion effect occurs for the measured velocity even for very pure tin. A.

534.23 : 532.7

182. ULTRASONIC RELAXATION THEORY FOR LIQUIDS. J.H.Andreae and J.Lamb.
Proc. Phys. Soc. B, Vol. 69, Pt 8, 814-22 (Aug., 1956).

The propagation of a sound wave through a liquid can be

described in terms of the absorption per wavelength μ and the velocity c. It is generally accepted that an important part of the absorption is due to the relaxation of internal degrees of freedom, and the aim of this paper is to derive relationships between the acoustic quantities μ and c and the thermodynamic parameters which describe specific molecular processes. The analysis is based on an expansion of the adiabatic compressibility. It is valid for the general case of structural relaxation involving changes both in internal energy and in volume as a molecule passes from one stable equilibrium state to another. Attention is given to the combined effects of more than one relaxing process, where each process has a different relaxation time. The equations are derived in a form suitable for the analysis of experimental results. A.

534.23

183. MOLECULAR ABSORPTION OF SOUND IN GASES AT HIGH TEMPERATURES. J.E.Young and O.K.Mawardi.
J. chem. Phys., Vol. 24, No. 5, 1109 (May, 1956).

Presents results of measurements of molecular absorption due to the so-called molecular thermal relaxation processes; the measurements were carried out with dry air at 2000 c/s and 600-1200°K. The results fit a curve $\mu = CT^{\beta}$, where μ is the absorption reduced to an attenuation per (waveguide) wavelength. F.Lachman

534.231.3 : 621.372

184. CONTINUOUSLY-VARIABLE ELECTRICAL, ACOUSTICAL AND MECHANICAL IMPEDANCES.
J.Y.Morton and R.A.Jones.
Post Off. Elect. Engrs' J., Vol. 49, Pt 1, 50-1 (April, 1956).

A theoretical basis, explained in electrical terms, is given for a continuously variable impedance. Then acoustical and mechanical analogues are described. The object was the simulation of the impedances of a number of individual human ears in connection with the design of an artificial ear. A practical example of the acoustical impedance is given. L.S.Goddard

534.232 : 534.6

185. NEW METHOD FOR THE CALIBRATION OF A PLANE HYDROPHONE. A.R.Laufer and G.L.Thomas.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 951-8 (Sept., 1956).

The high-frequency calibration of a plane disk hydrophone of large diameter by the usual plane-wave reciprocity method is a difficult task, requiring a large anechoic tank and precise mechanical alignment gear. A new and absolute calibration technique utilizing the radiation pressure of a standing-wave system is described. The calibration curve of a barium titanate hydrophone of diameter 1.5 in. and of resonant frequency 1.0 Mc/s is presented over the frequency range of 300 to 5000 kc/s. A.

534.372 : 532.623

186. NEW DAMPING MEASUREMENTS WITH VIBRATING AIR BUBBLES IN WATER. H.Haeske.
Nachr. Akad. Wiss.Göttingen, Math.-Phys., Kl IIa, No. 10, 239-56 (1955). In German.

The damping constants of air bubbles in water have been measured in the resonance frequency range 100 to 300 kc/s. The air bubbles investigated vary in radius from 10 to 30 mμ and dissolve in the water. A bubble initially 10 mμ radius has a life of only 1 sec. The measurements were made during the short life of the bubble by an impulse reflection method in a water-filled thick-walled glass tube of small internal diameter. The results are in general agreement with those of Exner and of Exner and Hampe (Abstr. 1583/1952, 2173/1954) and extend their work to a higher range of frequency. A.B.Wood

534.442.2

187. A QUICK ACTING SEARCH TONE SPECTROGRAPH FOR THE SPEECH-FREQUENCY REGION. S.Steinbach.
Nachrichtentechnik, Vol. 6, No. 8, 365-8 (Aug., 1956). In German.

Although natural speech contains frequencies in the range 90 to 8000 c/s it is sufficiently clear when limited to the frequency range 300 to 3000 c/s. The paper deals with the application of Grützmacher's search tone frequency analyser in relation to this restricted band of speech frequencies and deals with various band-pass filters and search tone bandwidths. It is shown that by this means the speed of speech analysis can be greatly increased. A.B.Wood

534.612 : 621.395.61

188. MEASUREMENT OF NOISE CANCELING EFFECTIVENESS OF MICROPHONES. L.M.Levine and J.Hershkowitz.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 973-6 (Sept., 1956).

The noise cancelling effectiveness of a microphone is determined by measuring the random noise discrimination as a function of frequency under conditions simulating actual usage, and then using this characteristic to compute the articulation index for an ideal system containing the microphone, when operating under specified noise and speech conditions. Results so obtained are shown to correlate with those of articulation tests for three microphones evaluated for three noise types at different noise levels. A.

534.614

189. MEASUREMENTS ON THE VELOCITY OF SOUND IN AIR UNDER PRESSURES UP TO 20 ATM COMBINED WITH THERMAL DIFFUSION. A.van Itterbeek and W.de Rop.
Appl. sci. Res. A, Vol. 6, No. 1, 21-8 (1956).

An acoustical interferometer has been constructed to measure the velocity of sound in gases under high pressures and low temperatures. Velocity measurements have been carried out down to the boiling point of liquid propane. During the measurements the influence of thermal diffusion could be observed. A few measurements are done by measuring the change of the velocity as a function of time. A.

534.614

190. SIMPLE FORM OF THE "SING-AROUND" METHOD FOR THE DETERMINATION OF SOUND VELOCITIES.
G.W.Ficken, Jr and E.A.Hiedemann.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 921-3 (Sept., 1956).

An arrangement for the determination of sound velocities in liquids by means of measuring pulse repetition rates is described which, although very simple, allows an accuracy of better than 1%. A.

534.7

PHYSIOLOGICAL ACOUSTICS. HEARING. See also under "Medical science. Human physiology". Decimal classification 612.85.

534.771

191. STUDY OF AUDIOMETER STANDARDIZATION.
R.Lehmann.
Onde élect., Vol. 36, 466-77 (May, 1956). In French.

Reviews a number of problems set by audiometer standardization, with particular reference to those relating to audiometer zeroing, that is, to the measurement of the average threshold of hearing. The various problems met in bone and air conduction and the many causes of error met by experimenters are considered. The difficulties met in the task of relating acoustical pressures measured on artifical ears are described. A.

534.78

192. SOME PRELIMINARY EXPERIMENTS ON BINAURAL TIME DELAY AND INTELLIGIBILITY. E.D.Schubert.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 895-901 (Sept., 1956).

Comparisons are made of the intelligibility of continuous speech in noise under three listening conditions: Speech arriving simultaneously and in phase at the two ears; speech arriving at one ear later than the other; and speech arriving simultaneously, but in opposite phase in one ear. Time intervals between ears ranged from 200 μsec to 7 msec. Delaying speech to one ear under these conditions does increase intelligibility but is little, if any, better than the simple expedient of wiring the phones so that the wave form at one ear is inverted with respect to the other. With the materials and method used, the maximum increase occurs with a delay between ears somewhere between 0.5 and 1 msec, though there is some indication that delays 1 msec and longer may be slightly better under the most difficult listening conditions tried. A.

534.78

193. EFFECTS OF VOCAL FORCE ON THE INTELLIGIBILITY OF SPEECH SOUNDS. J.M.Pickett.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 902-5 (Sept., 1956).

Measurements were made of the intelligibility of speech heard in noise and produced by different amounts of vocal force. Vocal force ranged from the weakest voiced whisper to a very heavy shout. The results show less than 5% deteriora-

tion in intelligibility over the range from a moderately low voice to a very loud voice (55 to 78 dB in a free field at one m from the lips). Beyond these points intelligibility decreases abruptly and in a linear relation to decibel change in vocal intensity. Listeners' errors are analysed to determine the effects of the extremes of vocal force on the intelligibility of different parts of the syllable and of different vowels. A.

534.781

194. "HUMAN 'CROSS-CORRELATOR'" — A TECHNIQUE FOR MEASURING CERTAIN PARAMETERS OF SPEECH PERCEPTION. E.C.Cherry and B.McA.Sayers.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 889-95 (Sept., 1956).

A human listener is here regarded as a "cross-correlator"; his two ears are treated as "input terminals", stimulated with the acoustic input signals $f_1(t)$ and $f_2(t + \tau)$, while his vocal responses are treated as the output "correlation function". The two signals are, respectively, pure and distorted versions of the same signal (perhaps speech). The delay τ is randomly set and the listener answers right or left, as the source of sound appears to him to lie. The "correlation function" then corresponds to the probability distribution of his correct judgments. Such functions represent the degree of aural fusion, and show up strikingly the invariants of speech signals which are significant in aural perception. A.

534.79

195. CALCULATION OF THE LOUDNESS OF COMPLEX NOISE. S.S.Stevens.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 807-32 (Sept., 1956).

Charts and formulae are presented for the calculation of the loudness of noises having approximately continuous spectra. By means of direct loudness matches it is shown that the loudness in octave bands can be combined according to the formula $S_t = S_m + 0.3\,(\Sigma S - S_m)$, where S_t is the loudness (in sones) of the total noise, S_m is the loudness of the loudest band, and ΣS is the sum of the loudnesses of all the bands. The loudnesses of the octave bands can be determined from measurements of their sound pressure levels by means of a chart based upon a new determination of the equal loudness contours for bands of noise. Other charts and formulae are presented for half- and third-octave band widths. Measurements were also made of the dependence of loudness on such factors as (a) separation between noncontiguous bands, (b) width of very narrow bands, and (c) rate and level of square wave modulation. A.

534.83

196. ELECTRONIC CONTROL OF NOISE, VIBRATION, AND REVERBERATION. H.F.Olson.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 966-72 (Sept., 1956).

Existing passive materials are inadequate to cope with many problems in the control of noise, vibration and reverberation. It is only within quite recent times that active systems have been given consideration for the control of sound. The electronic sound-absorber is an example of an active type sound absorber. The electronic sound-absorber consists of a microphone, amplifier, and loudspeaker connected in an inverse feedback manner. The electronic system reduces the effective acoustical impedance in the vicinity of the absorber. As a consequence, the electronic sound-absorber may be used in the manner of a conventional sound absorber or as a zone-type sound reducer. The electronic vibration-reducer consists of a sensor, amplifier, and driver connected either in negative or positive feedback fashion. The electronic vibration reducer may be used to isolate vibrating machines or to reduce the vibration of machines. A.

534.831

197. LOUDNESS ADAPTATION FOR BANDS OF NOISE. E.C.Carterette.
J. Acoust. Soc. Amer., Vol. 28, No. 8, 865-71 (Sept., 1956).

Loudness adaptation may be measured by a simultaneous loudness balance, or, as in the two experiments reported, by a median plane localization of a dichotically presented acoustic stimulus. The loudness of a steady auditory stimulus generally decreases with time. That is, the intensity of a comparison stimulus in the rested ear is ordinarily set below the intensity in the stimulated ear. Two experiments were done on loudness adaptation for bands of noise. In Experiment 1, using 36 subjects, loudness adaptation for a wide-band thermal noise of 100-5000 c/s was studied as a function of five SPL's: 40, 70, 90, 100 and 105 dB over all. The mean maximum loudness adaptation obtained was 2.3, 9.9, 11.4, 14.4 and 16.3 dB, respectively. The mean standard deviation for all measures was 6.1 dB, and the distributions of the sets of measures tended to be skewed toward greater adaptation. In Experiment 2 (12 subjects), the loudness adaptation for a 1500 c/s tone was compared with that for bands of noise whose centres (mel scale) were at 1500 c/s, and whose over-all SPL's were equal to the SPL of the pure tone. The band limits in cycles per second were 1280-1720, 1075-1950, 720-2600 and 100-4900. For each band, adaptation was measured for 50, 70 and 90 dB SPL over all. The essential results are: (1) Loudness adaptation for 1500 c/s is about 8.5 dB greater than the maximum adaptation for any noise band at any SPL; (2) Adaptation is small (4.5 dB) at 50 dB for all bands of noise; it is complete within one minute and is about equal for all band widths; (3) At 70 and 90 dB, time taken for complete adaptation increases and the two widest bands give greater adaptation than the two narrowest bands. At 90 dB a trend becomes clear: the wider the band, the greater the degree of adaptation and the longer the time required for maximum adaptation to be attained. A.

534.831

198. ANNOYANCE THRESHOLD JUDGMENTS OF BANDS OF NOISE. W.Spieth.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 872-7 (Sept., 1956).

Annoyance threshold judgments were obtained by exposing an individual to noise for three minutes and asking him to adjust the intensity to the level which, if any louder, would annoy him if it were present most of the time where he was working. In one experiment, 21 people made judgments about 13 bands of noise which covered the frequency range of 50 to 13 000 c/s, and subsequently made sets of equal loudness matches. No differences were found between annoyance threshold curves and equal loudness curves. In a second experiment, each of 162 people made one annoyance judgment. When these annoyance thresholds were transformed into equivalent loudness terms, the resultant annoyance threshold curve varied reliably with frequency only in that the threshold on the highest band (6600-9000 c/s) was reliably lower than those on lower frequency bands. Office workers who had once worked in noisy situations as well as those working in noisy situations at the time of the experiment gave thresholds about 15 dB higher than did people who had only worked in office-type situations. Within a group who had worked only in quiet situations, those who tried to imagine themselves in an actual working situation gave thresholds that averaged about 15 dB higher than the thresholds of those who did not. A.

534.835

199. CRITERIA FOR OFFICE QUIETING BASED ON QUESTIONNAIRE RATING STUDIES. L.L.Beranek.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 833-52 (Sept., 1956).

In order to discover what are the maximum noise levels that office personnel find acceptable and what their reactions are to noisy offices, a survey was carried out at a large air base. A questionnaire composed of 15 rating scales was administered to 190 people scattered over 17 different locations on the base. The rating scales allowed the workers to assess such things as the "noisiness" of their environment and to appraise the effect of noise on various aspects of their work, such as their ability to converse or to use the telephone. The results obtained with the rating scales were compared with various physical measures of the noise. A high correlation was found between perceived noisiness and the measure called "speech interference level" SIL, which is the average of the sound pressure levels measured in the three octave bands between 600 and 4800 cycles per second. An even higher correlation was found between the ratings of noisiness and a computed measure of loudness level. More than two-thirds of those questioned stated that speech communication was an essential part of their activities and that the more intense noises in their offices interfered with it. These correlations provide a basis for setting criteria for the maximum noise acceptable in terms of SIL and of loudness level. These results, plus those from a previous study, suggest that the maximum continuous noise levels acceptable for office spaces in which speech communication is important should not exceed an SIL of 40 db. Office employees are accustomed to a noise spectrum of a form that yields a loudness level of about 22 units higher than the SIL. Complaints are encountered when the loudness level exceeds the SIL by 30 or more units. Thus, with an

SIL of 40 db the loudness level should preferably not exceed about 62 phons. Only under special conditions with this SIL would it be advisable to exceed a loudness level of 70 phons. For intermittent noises, such as the noises produced by aircraft operations, evidence is presented to show that the mean (average) value of the SIL and loudness level should not exceed the numbers for steady noises if the work of office employees is not to be disturbed. A.

534.837 : 621.314.2

200. TRANSFORMER ACOUSTICAL STUDIES WITH SCALE MODELS. R.J.Ringlee.
Conf. Internat. Grands Réseaux Elect. (CIGRE), 1956, Paper 128, 17 pp.

Data are presented with regard to the nature of the sound field about transformers, the effect of distance and the effect of partial enclosures. Much of the data were obtained by using scale-model transformers in scaled installations and these are compared with full-scale data where possible. Special attention is paid to the effect of external barriers. A bibliography is added. R.G.Jakeman

534.839

201. NOISE MEASUREMENTS: PHYSICAL AND PHYSIOLOGICAL PROBLEMS. P.Baron.
Onde élect., Vol. 36, 450-65 (May, 1956). In French.

The examination of the physical characteristics of noise: the determination of the acoustic power of sound sources and the calculation of acoustic pressure at any point in a medium: application to the study of machine noise. Essential characteristics of apparatus for measuring, analysing and recording noise. Precautions to be taken. Physiological aspects of noise, determination of their annoyance value; this subject is very complex, and this measurement comes back to a comparison between noises of similar types. A.

534.84

202. ARCHITECTURAL ACOUSTICS. J.Matras.
Onde élect., Vol. 36, 384-415 (May, 1956). In French.

In relation to sound proofing problems the author deals successively with the definition of noise, its measurement, analysis and physiological effects; with a definition of sound insulation and with sound insulation measurements; with attenuation in sound transmission and with noise reduction factor. Also dealt with are: tolerable noise levels indoors and noise levels from outside sources; the progress of sound propagation through openings (windows, doors, along pipes....) and through the diaphragm effect of walls and by conduction. No sound-proofing methods are described. In relation to interior acoustics, "static" acoustics (case of average-size interiors), "geometrical" acoustics (large interiors), "wave" acoustics (small interiors) are discussed. Finally, a list is given of modern quality requirements and standards in interior acoustics: period of reverberation, shape, definition of sound. A.

534.842

203. EXPERIMENTAL INVESTIGATION OF THE ACOUSTICS OF AN OPEN SPACE USING A DISTRIBUTED SYSTEM OF SPEAKERS. B.D.Tartakovskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 636-9 (1956). In Russian.

The use of a large number of small loudspeakers, in contrast to a few powerful speakers, for public address systems has been investigated. It was found that there is an optimum number and spacing for speakers. J.B.Arthur

534.844

204. MEASURED ABSORPTION CHARACTERISTICS OF RESONANT ABSORBERS EMPLOYING PERFORATED PANEL FACINGS. E.E.Mikeska and R.N.Lane.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 987-92 (Sept., 1956).

Reverberation chamber measurements are presented for resonant absorber constructions covering a range of resonant frequencies. Types of constructions tested were (1) thick layers of porous material covered by the facing and backed by a hard wall and (2) facings covered with a resistive cloth layer and mounted with air space backing. Measurements were made with thicknesses up to $14\frac{1}{2}$ in. behind the panel to secure high absorption at low frequencies. A.

534.845

205. NOTES ON THE ACOUSTICAL PROPERTIES OF MATERIALS. T.Vogel.
Onde élect., Vol. 36, 428-34 (May, 1956). In French.

The propagation of sound within an enclosure sets a "boundary problem" which involves the observation of certain "wall" conditions. One plausible aspect of wall condition, similar to that met in thermokinetics, eventually leads to defining the materials in terms of specific "impedance". This impedance may be likened to the coefficient of absorption measured for different angles of incidence in plane-wave conditions, and also, to the period of reverberation. Sabine's semi-empirical formula, currently applied in acoustical engineering, actually seems to be a "limit" case: it is possible to get close to that limit case, but only with conditions well remote from those prevailing in reverberation chambers. For that reason, the author prefers the incidence method described in the present article, whereas, to his mind, the use of Sabine's formula should be restricted to preliminary work on rooms of relatively high absorption coefficients. A.

534.861 : 621.396.712.3

206. MODERN STUDIOS OF THE RADIO CENTRE OF MARSEILLES. J.Pujolle.
Onde élect., Vol. 36, 419-21 (May, 1956). In French

The new Radio Centre of the R.T.F. in Marseilles was constructed between 1952 and 1954 in a building of the Parc Chanot, the old Palais des Congrès. The Centre comprises a main building where are provided: (1) five sound studios and a wing added to the old building for television; and (2) one large studio of volume 3000 m^3 used for transmissions by the Symphony Orchestra. The other four studios, of which one has a volume of 800 m^3 for radio—theatre and variety, and three smaller studios, have been treated by a new process, based on a plastic material specially produced for this centre. A.

OPTICS. RADIATION. SPECTRA 535

535.01 : 612.84

207. A REVIEW OF THE BASIS OF THE OPTICS OF THE 17th CENTURY. V.Ronchi.
Optik, Vol. 13, No. 7, 322-35; No. 8, 337-49 (1956). In German.

A review is given of modern theories relating to the performance of optical systems and the eye. The philosophical principles underlying the many approaches to these subjects are discussed. The methods associated with Kepler and other 17th century opticians are considered from these viewpoints. R.W.Fish

535.1

208. OPTICAL SINGLE SIDE-BAND TRANSMISSION USING THE GABOR MICROSCOPE. A.Lohmann.
Optica Acta, Vol. 3, No. 2, 97-8 (June, 1956). In German.

Recent work has emphasized the analogy between electrical network theory and optics. This paper discusses methods of obtaining an optical analogy of the single side-band transmission, common in electrical work. R.W.Fish

535.225 : 530.12

209. A NEW OPTICAL RELATIVISTIC EXPERIMENT. A.M.Bonch-Bruevich and V.A.Molchanov.
Optika i Spektrosk., Vol. 1, No. 2, 113-24 (1956). In Russian.

The paper is concerned with a direct experimental verification of the relativistic assumption of the independence of the velocity of light with respect to the velocity of the emitting source relative to the observer. The apparatus is described briefly and results given of a comparison of the time to cover a fixed path with light emitted by the left and right equatorial regions of the sun. The results of the measurements confirm the second postulate of the theory of relativity. 30 refs., including 8 Russian. C.R S.Manders

535.23 : 536.33 : 538.56

210. THE MEAN EFFECTIVE LENGTH OF RAYS. V.I.Pukhov.
Zh. tekh. Fiz., Vol. 26, No. 5, 1080-93 (1956). In Russian.

In specifying the radiation enclosed within a gas-filled body of arbitrary shape it is convenient to express it as the radiation from a hemisphere having the radius equal to the "effective length of rays". Calculation of this quantity is discussed in general terms and carried out for bodies of simple shape. R.Eisenschitz

535.234 : 518.5

211. DIRECT-READING PLANCK DISTRIBUTION SLIDE RULE. R.S.Knox.
J. Opt. Soc. Amer., Vol. 46, No. 10, 879-81 (Oct., 1956).

Theory and general design data for a two-dimensional slide-action alignment chart giving a direct reading of the Planck distribution function are presented. Accuracy and convenient size are complementary; a "pocket" model covering 200° to 10 000°K yields one or two place accuracy in spectral density. A.

535.245

212. NEW DETECTOR UNIT FOR IRRADIANCE MEASUREMENTS, UTILIZING AN INTEGRATING SPHERE AND A PHOTOMULTIPLIER TUBE. P.L.Tea, Jr and H.D.Baker.
J. Opt. Soc. Amer., Vol. 46, No. 10, 875-8 (Oct., 1956).

A detector unit of novel design is described which has been used successfully in model-chamber studies using visible light as a source of radiation, devised to find the geometric factors required for calculation of solid-to-solid radiant-heat-transfer problems. The detector unit may also be employed in investigations of inter-reflections in model rooms. Some of the useful properties of this detector unit are negligible cosine error, little fatigue, and linearity of response. A.

535.246

213. AN ABSOLUTE PHOTOMETER FOR LARGE INTENSITY RATIOS. F.Link.
Rev. Opt., Vol. 35, No. 3, 129-35 (March, 1956). In French.

Theoretical and constructional details of a sensitive visual photometer for the absolute measurement of very large intensity ratios, e.g. between sun and (i) stars, (ii) planets, or (iii) twilight sky. D.R.Barber

535.247.4

214. LATEST DEVELOPMENTS IN TECHNICAL PHOTOMETERS. H.Korte.
Arch. tech. Messen, Issue No. 246 (Ref. J 333-3), 165-6 (July, 1956). In German.

Describes the principle of photometry with a photocell and a filter correcting its sensitivity curve to that of the standard observer. The first part of the paper deals with the use of the photovoltaic cell in this way, the second with the growing use of the photomultiplier cell, a comparatively new development. J.W.T.Walsh

535.247.4

215. SOME ASPECTS OF PHOTOMETRY WITH A PHOTOELECTRIC (CELL) MONOCHROMATOR. R.Grandmontagne.
Rev. Opt., Vol. 35, No. 6, 355-8 (June, 1956). In French.

For optical systems in which a condensing lens of large relative aperture is interposed between monochromator exit slit and photo-receiver, the shape and size of the photocell are important. Provided also that objectives of sufficiently large diameter are employed in the monochromator system, its relative aperture may be made small without undue loss of sensitivity. D.R.Barber

535.317

216. THE USE OF MATRIX CALCULUS IN PARAXIAL OPTICS. A.Maréchal.
Rev. Opt., Vol. 35, No. 3, 166-71 (March, 1956). In French.

The paper shows that the use of a two-line square matrix allows the connection of the incident and emergent rays within the Gauss approximation. This clearly shows the linear character of the Gauss region. For off-axis rays, complex numbers are used. R.W.Fish

535.317.1

217. IMAGE FORMATION BY RECONSTRUCTED WAVE FRONTS. I. PHYSICAL PRINCIPLES AND METHODS OF REFINEMENT. P.Kirkpatrick and H.M.A.El-Sum.
J. Opt. Soc. Amer., Vol. 46, No. 10, 825-31 (Oct., 1956).

The process of image formation by reconstructed wave fronts, brought to notice and placed upon a broad theoretical foundation through the writings of D. Gabor, is here discussed from a less abstract standpoint in an attempt to establish a satisfying conceptual explanation of the phenomena. The imperfections which the photographically recorded images ordinarily exhibit are accounted for and classified, and means for their removal are described. Sample reconstructions are presented. A.

535.317.6

218. GRAPHICAL STUDY OF THE BEST FOCUS IN WIDE-APERTURE OPTICAL SYSTEMS. C.Morais.
Alti Fond. Ronchi, Vol. 11, No. 3, 231-42 (May-June, 1956). In Italian.

A method is described for the graphical determination of the best focus of an optical system having spherical aberration of high order. This method consists in deriving the spherical aberration diagram. As an example the method is applied to a projection system of 200 mm focal length and 1/0.7 relative aperture, which has been designed at the Istituto Nazionale di Ottica. Then the formulae are applied to the known simplest cases of spherical aberration not exceeding the 5th order. A.

535.325

219. DISPERSION OF AIR IN THE VISIBLE REGION OF THE SPECTRUM. V.P.Koronkevich.
Optika i Spektrosk., Vol. 1, No. 1, 85-9 (1956). In Russian.

Experiments are described in which the dispersion of air was measured in the visible region from 4471 A to 6678 A using an interferometer method due to A.A.Lebedev (Survey of the work of the Commission on Units of Measurement: Press of the Academy of Sciences of the U.S.S.R., 1938, p.67) which in its turn is a modification of a method due to D.S.Rozhdestvenskiĭ (Thesis, St.Petersburg, 1912). A dispersion formula for dry air, free of CO_2 at 20° C and 760 mm Hg is given as

$$(n - 1) \times 10^{-6} = 267.982 + 1.5187/\lambda^2 + 0.01407/\lambda^4,$$

where λ is the wavelength in vacuum. C.R.S.Manders

535.33

220. EMISSION SPECTRA EXCITED BY ELECTRONIC AND IONIC IMPACT. C.Y.Fan.
Phys. Rev., Vol. 103, No. 6, 1740-5 (Sept. 15, 1956).

Summarizes results of laboratory experiments on the optical emission of a rarefied air sample excited by the impact of electrons (10-8000 eV), protons (5-350 keV), and He^+ ions (10-450 keV). In the high-energy region, charged particles of different species but of the same velocity excite very much the same spectrum. In the low-energy region, on the other hand, the process of charge exchange plays such an important role that the spectra show marked characteristics of the species of the particles which cause the excitation. The relative band intensities of the negative system of N_2^+ and the relative intensities of the negative to the Meinel system of N_2^+ excited by low-energy particles depart notably from the prediction of the Franck–Condon principle. The importance of energy transfer in the process of charge exchange is discussed. A.

535.33

221. EMISSION IN THE INFRARED. K.A.Fischer and G.Brandes.
Naturwissenschaften, Vol. 43, No. 10, 223-4 (1956). In German.

Experiments with polythene foil at up to 200°C indicate that infrared emission is a greater source of interference in studies of absorption spectra than parasitic radiation. The possibility is being investigated of utilizing emission infrared spectra, when recording of absorption spectra is difficult (opaque substances). R.C.Murray

535.33.03

222. TECHNIQUE FOR STUDYING THE EFFECT OF AN ADDITIVE ON A FLAME SPECTRUM. F.P.Dickey, S.Kopczynski and G.Bell.
J. chem. Phys., Vol. 25, No. 1, 180-1 (July, 1956).

Infrared spectra are studied using a pulsating flow of gaseous additive to modulate the flame radiation instead of the usual mechanical chopper. The spectrum then shows mainly bands produced by the additive. Addition of sulphur hexafluoride to a CO–air flame is used as example. A.G.Gaydon

535.33.03 : 536.46

223. EXPERIMENTAL PROOF FOR THE EXISTENCE OF NONTHERMAL ROTATIONAL DISTRIBUTIONS OF OH ($^2\Sigma^+$) IN FLAMES. H.P.Broida and H.J.Kostkowski.
J. chem. Phys., Vol. 25, No. 4, 676-80 (Oct., 1956).

Experiments have been carried out to determine whether nonthermal rotational distributions in the $^2\Sigma^+$ electronic state of OH observed in certain flames are caused by self-absorption. A study of emission (single and double path) and absorp-

tion by OH between 3064 A and 3350 A in atmospheric and low-pressure flames has shown that self-absorption is negligible in at least two cases in which nonthermal distributions are found. This leads to the conclusion that anomalous "temperatures" of OH measured previously in hydrocarbon flames at low pressure and in highly diluted flames at atmospheric pressure are real. A.

535.33.03

224. ZIRCONIUM ARC SOURCE FOR INFRARED MICRO-SPECTROMETER. W.H.Cloud.
J. Opt. Soc. Amer., Vol. 46, No. 10, 899-900 (Oct., 1956).

Methods have been explored for magnifying the crater of a water-cooled 100 W zirconium arc infrared source to fill the approximately 6 mm slit height accommodated by a Perkin–Elmer microscope attachment. Two optical systems were used: a large Schwarzschild mirror system similar to that used as a condenser in the microscope attachment and a combination of a f/1 sphere and a flat with a hole in its centre. These systems gave a considerable increase in energy over that of the globar operated at 200 W: approximately 2.25 : 1 at 14 microns, 4 : 1 at 4 microns, and much higher factors at shorter wavelengths. The factor of 2.25 at 14 microns where Rayleigh–Jeans formula should be valid is approximately what would be predicted from the relative temperatures of the zirconium arc and the globar. The magnified zirconium arc is not as intense as a carbon arc. From the standpoint of convenience, the zirconium arc is superior to the carbon arc in that it requires no changing of electrodes and gives a compact, totally enclosed source with a short air path which can easily be flushed free of atmospheric gases which absorb in the infrared. A.

535.33.07 : 535.375.5

225. THEORY AND CONSTRUCTION OF A HIGH PERFORMANCE RAMAN SPECTROGRAPH. B.H.Messikommer.
Dissert. E.T.H. Zurich, Paper 2373, 85 pp.(1954). In German.

The optical design is discussed using the matrix method of Harris (Abstr. 2499/1951). The instrument uses three 60° glass prisms with faces 12 x 13 cm. The camera has f = 70 cm. Tests on CCl_4 and C_6H_6 require an exposure time of about 30 sec. G.F.Lothian

535.33.07

226. INTERFEROMETRIC SPECTROSCOPY IN THE FAR INFRA-RED. H.A.Gebbie and G.A.Vanasse.
Nature (London), Vol. 178, 432-3 (Aug. 25, 1956).

A compact apparatus is used to record the fringe pattern from a continuous change of path difference in a reflection interferometer. The Fourier transform, giving the spectral transmission in the interferometer path, is calculated with a high-speed digital computer. The rotation spectrum of water vapour for 60-120 cm^{-1} is so determined. G.F.Lothian

535.33.07

227. OPTICAL INSTRUMENTS FOR THE VACUUM ULTRAVIOLET. R.W.Ditchburn.
Optica Acta, Vol. 3, No. 2, 74-80 (June, 1956).

The limitations on the design of optical instruments for the regions 2000 A-1200 A (near vacuum ultraviolet) and 1200 A-200 A (far vacuum ultraviolet) due to (a) the necessity of enclosing the optical path in vacuum and (b) the properties of optical materials in these regions are stated. A.

535.33.07

228. THE ADAPTATION OF AN ELECTRON MULTIPLIER TO A PLATE SPECTROGRAPH. J.Lenoble.
Optica Acta, Vol. 3, No. 2, 95-7 (June, 1956). In French.

A detailed description is given of a modification to a spectrograph using photographic plates, allowing the use of a seven-stage photomultiplier for additional sensitivity. An outline of some results is given. R.W. Fish

535.33.07

229. FREQUENCY-LINEAR DRIVE FOR SPECTROGRAPHIC RECORDER. W.E.Deeds.
Rev. sci. Instrum., Vol. 27, No. 7, 543-4 (July, 1956).

A Fabry–Perot etalon gives fringes of constant frequency interval so that the amplified photoelectric current from these fringes used to drive a recording chart synchronously will give a uniform frequency scale on the chart. G.F.Lothian

535.33.07 : 535.243 : 539.155.2

230. AN INFRARED SPECTROPHOTOMETER AND ITS USE FOR THE ISOTOPIC ANALYSIS OF HEAVY WATER. R.Skjöldebrand.
Appl. sci. Res. B, Vol. 5, No. 5, 401-8 (1956).

An infrared spectrophotometer for the region 2-4 μ was constructed for the isotopic analysis of heavy water. It proved useful in the concentration regions from 0.015 to 3 w/w% D_2O and from 90 to 99.80 w/w % D_2O. It provides a very fast and highly accurate method for isotopic analysis. A.

535.331

231. THE SPECTRUM OF SINGLY-IONIZED CALCIUM, Ca II. B.Edlén and P.Risberg.
Ark. Fys., Vol. 10, Paper 39, 553-66 (1956).

The spectrum of ionized calcium has been observed from 3000 to 12 000 A by using a hollow-cathode light source and a large concave-grating spectrograph. A list of improved wavelengths is given. Several new multiplets, mainly in the infrared, have been found, permitting the identification of a number of fairly strong lines in the solar spectrum. A complete recalculation of the term system on the basis of the new data gives a significantly improved and fairly uniform accuracy of about 0.03 cm^{-1} for both relative and absolute term values. By suitably extending the Ritz formula and by applying the polarization theory for nearly hydrogen-like terms simple extrapolation formulae have been derived, by means of which the observed term system may be arbitrarily extended. From the revised term values accurate wavelengths have been calculated for use as standards in the Schumann region. The investigation gives a reminder of the fact that our knowledge of many simple and seemingly well known atomic spectra still leaves much to be desired and may be usefully improved by relatively simple means, especially by reobserving the photographic infrared. A.

535.331

232. EXTENSION OF THE ANALYSIS OF THE THIRD SPECTRUM OF IRON, Fe III. S.Glad.
Ark. Fys, Vol. 10, Paper 22, 291-340 (1956).

The Fe III spectrum has been studied in the region 8600-2600 A by using a condensed hollow cathode discharge. This produces the Fe III spectrum with good intensity and at the same time it is possible to separate the Fe III lines from those of Fe I and Fe II by studying the shape of the lines. A comparison with the vacuum spark shows that the strongest Fe IV lines in the visible region appear only as very faint traces in the hollow cathode. About 2000 lines, experimentally classified as Fe III, have been measured between 8600 and 2600 A. Analysis of the new data has led to the classification of terms arising from the configurations $3d^5 5s$, $3d^5 6s$, $3d^5 4d$, $3d^5 5d$ and $3d^5 5p$. In connection with this analysis about 100 of the hazy lines observed by Edlén and Swings in the vacuum ultraviolet around 1400-1600 A and due to $3d^5 4p - 3d^5 5s$ and $3d^5 4p - 3d^5 4d$ have been classified. In the (^{6}S) system terms attributable to the configurations $3d^5 7s$, $3d^5 6p$, $3d^5 6d$, $3d^5 5f$, $3d^5 6g$ and $3d^5 6h$ have been found. From the last three members of the series $3d^5(^6S)ns\,^7S$ (n = 5, 6, 7) an ionization potential of 247 221 cm^{-1} or 30.643 volts has been calculated. The tables contain about 200 new levels and approximately 800 newly-classified lines. A.

535.331

233. MEASUREMENTS OF THE HYPERFINE STRUCTURE AND ISOTOPE SHIFT OF Hg LINES WITH A COMPLEX FABRY–PEROT ETALON. F.A.Korolev and V.I.Odintsov.
Optika i Spektrosk., Vol. 1, No. 1, 17-21 (1956). In Russian.

The paper describes some studies of the mercury lines at 5461, 5770, 5790 and 4358 A using a double Fabry–Perot interferometer developed by one of the authors. C.R.S.Manders

535.332

234. A STUDY OF C IV: TERM VALUES, SERIES FORMULAE, AND STARK EFFECT. K.Bockasten.
Ark. Fys., Vol. 10, Paper 40, 567-82 (1956).

The spectrum of C IV has been studied in the region 9950-1900 A by means of a sliding vacuum spark. Thirty-five lines have been measured, twenty-two of which had not been observed before. The resonance doublet, λ 1548, has been remeasured on some old plates. On the basis of this material and the wavelengths of ten lines in the region 1250-380 A given

by Edlén the term system has been recalculated. The hydrogen-like terms are strongly affected by Stark effect from the ionic field in the light source, and the Stark effect patterns of the transitions 5-6, 5-7, 5-8, 6-7, 6-8, and 6-9 are found to agree closely with those of the Balmer lines of hydrogen having the same difference in principal quantum number. The polarization formula for hydrogen-like terms was tested on term series Mg II and Li I and then used for calculating unaffected values of hydrogen-like terms in C IV. From these values the Stark effect levels have been computed and are given in graphs as functions of the field strength for n = 5, 6, and 7. The transition 5-7 has been studied graphically. The observed Stark effect displacements correspond to an effective ionic field of about 25 kV/cm. The unaffected term values deduced from the observations are given in a special table. A.

535.333

235. RADIATION OF MOLECULES IN THE PRESENCE OF A STRONG HIGH-FREQUENCY FIELD. V.M.Faĭn.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 878-80 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 747-9 (July, 1956).

Factors affecting the radiation frequency are theoretically discussed. G.I.W.Llewelyn

535.333

236. ROTATIONAL ANALYSIS OF THE β' BAND ($B'^2\Delta - X^2\Pi$) OF THE NO MOLECULE. E.Miescher.
Helv. phys. Acta, Vol. 29, No. 4, 401-9 (1956). In German.

From high dispersion spectra, obtained in the fourth order of a 3 m vacuum spectrograph, rotational analyses have been made of NO emission bands ($B'^2\Delta_i - X^2\Pi$) in the Schumann region. The following constants of the upper state are determined:

$B'^2\Delta_i$:	$T_e = 60\,364.5\ cm^{-1}$	$\omega_e = 1216.6$	
		$\omega_e x_e =$	$15.88\ cm^{-1}$
	$B_e = 1.330\ cm^{-1}$	$\alpha =$	$0.019\ cm^{-1}$
	$r_e = 1.303$ A	$A =$	$-2.4\ cm^{-1}$

It is suggested that the configuration $\sigma\pi^4\pi^2$ forms the $^2\Delta$-term. A.

535.333

237. AN EMISSION SPECTRUM OF THE DIACETYLENE ION. A STUDY OF SCHÜLER'S "T" SPECTRUM UNDER HIGH RESOLUTION. J.H.Callomon.
Canad. J. Phys., Vol. 34, No. 10, 1046-74 (Oct., 1956).

Schüler and Reinebeck have described a new spectrum which was observed in a discharge through a mixture of an inert gas and the vapour of any of a number of organic compounds. This spectrum was labelled "T". Further experiments by the authors provided evidence that the carrier of the "T" spectrum was the diacetylene molecule. The "T" spectrum has now been reinvestigated using both normal and fully deuterated diacetylenes in a helium discharge and photographed on grating instruments with very high resolving powers. Previous vibrational assignments were extended, and the rotational structure was completely analysed in four bands. The results, together with other evidence, show that the carrier of the "T" spectrum is the diacetylene ion, $C_4H_2^+$. The vibrational and rotational constants differ but little from those of the diacetylene ground state. The spectrum involves a transition between the first excited state $A^2\Pi_u(i)$ and the ground state $X^2\Pi_g(i)$ of the ion and is analogous in detail to the well-known Fox, Duffendack and Barker system of CO_2^+. A.

535.338

238. POLARIZATION OF THE CONTINUOUS SPECTRUM IN A GAS DISCHARGE. B.V.Paranjape.
Proc. Phys. Soc. B, Vol. 69, Pt 7, 765-8 (July, 1956).

A theoretical note deriving the degree of polarization of light (due to radiative recombination) observed at right angles to a discharge channel, in terms of the electron temperature and other basic quantities. It is shown that the effect should be observable. J.D.Craggs

535.338.3

239. ATOMIC OSCILLATOR STRENGTHS AND EXCITATION POTENTIALS. C.W.Allen and A.S.Asaad.
Monthly Not. Roy. Astron. Soc., Vol. 115, No. 5, 571-4 (1955).

The ratio between calculated and observed oscillator strengths is discussed for atoms of the astrophysically important iron group (Ti to Ni). The ratio is found to vary systematically and very greatly with excitation potential, being high for small E.P. Reasons are advanced for believing that observed values may be preferred to calculated values. The data lead to the surprising result that there is a general increase of true oscillator strength (factor of 1000 or more) for observed lines as E.P. increases by 3 or 4 volts. A.

535.338.332

240. FINE STRUCTURE OF THE LINE He^3 II λ = 4687 A WITH A CALCULATION OF LAMB'S DIFFERENCE TERM $nS_{1/2}$. P.S.Kireev.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 2, 226-7 (1956). In Russian.

Measurements, made with a Fabry–Perot etalon, gave $3S_{1/2} = (116 \pm 15) \times 10^{-3}\ cm^{-1}$ and $4S_{1/2} = (64 \pm 30) \times 10^{-3}\ cm^{-1}$. J.M.Hough

535.338.334 : 523.025.338.334

PROBLEMS OF STARK BROADENING FOR EXPERIMENTAL AND ASTRONOMICAL SPECTRA LIABLE TO SELF-ABSORPTION. See Abstr. 11

535.34.07 : 539.152.2

241. A SPECTROMETER FOR HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE EXPERIMENTS. G.Lindström and B.N.Bhar.
Ark. Fys., Vol. 30, Paper 36, 489-99 (1956).

An apparatus for the studies of "chemical shift" and other details of the nuclear resonance lines in liquids is described here with detailed procedures, experimental technique and design of the radio-frequency bridge and permanent magnet used in the experiment. The origin of the "chemical shift" and fine components of nuclear magnetic resonance spectra is also discussed here. Bloch's method of "line-narrowing" by macroscopic motion of the sample is utilized here to observe the splitting of nuclear resonance lines originating from electron-coupled spin–spin interaction of non-equivalent protons in ethyl alcohol. The resolution of the apparatus is at present of the order of one part in 10 millions. A.

535.34.08

242. HIGH TEMPERATURE MODIFICATION OF THE BECKMAN DU SPECTROPHOTOMETER. B.R.Sundheim and J.Greenberg.
Rev. sci. Instrum., Vol. 27, No. 9, 703-4 (Sept., 1956).

A modification is described which permits the observation of absorption spectra of liquid systems up to 650°C. A.

535.343 : 538.22

243. ABSORPTION SPECTRUM AND MAGNETIC PROPERTIES OF YTTERBIUM CHLORIDE. G.H.Dieke and H.M.Crosswhite.
J. Opt. Soc. Amer., Vol. 46, No. 10, 885-9 (Oct., 1956).

The absorption spectrum of $YbCl_3.6H_2O$ has two sharp lines near 9700 A which are interpreted as the transitions from the M = 5/2 Stark component of the $^2F_{7/2}$ level of the Yb^{+++} ion to the M = 3/2 and 5/2 levels of the other doublet component $^2F_{5/2}$. The Zeeman splittings of the two lines were investigated at 4°K as a function of the orientation of the crystal. They can be interpreted by assuming that the crystal field has a pronounced magnetic symmetry axis (probably sixfold) perpendicular to the twofold symmetry axis of the crystal. The magnetic ellipsoid is degenerate into a pair of planes perpendicular to this axis. The direction of the magnetic axis is slightly different for the three observed states and bears no relation to the optic axes of the crystal. A.

535.343

244. THE ULTRAVIOLET ABSORPTION SPECTRUM OF META-FLUOROCHLOROBENZENE. S.L.N.G.Krishnamachari.
Indian J. Phys., Vol. 30, No. 3, 151-2 (March, 1956).

A band system of the vapour at 2350-2850 A has been analysed and vibrational frequencies are tabulated. G.F.Lothian

535.343

245. THE ULTRAVIOLET ABSORPTION SPECTRUM OF PARA-FLUOROCHLOROBENZENE. S.L.N.G.Krishnamachari.
Indian J. Phys., Vol. 30, No. 6, 319-20 (June, 1956).

A band system for the vapour of 2375-2940 A has been analysed in terms of five ground state and five excited state vibrations. G.F.Lothian

535.343

246. ULTRAVIOLET ABSORPTION SPECTRA OF PHENYL ACETONITRILE, PHENYL ACETATE, PHENYL SALICYLATE AND MONOMERIC STYRENE IN THE LIQUID AND SOLID STATES. S.K.Sen.
Indian J. Phys., Vol. 30, No. 7, 321-33 (July, 1956).

Absorption spectra of phenyl acetonitrile, phenyl acetate, phenyl salicylate and monomeric styrene in the liquid and solid states at low temperatures have been investigated and the results have been compared with those for vapours and for solutions of these substances. The absorption spectrum of phenyl salicylate in the vapour state has also been studied and the prominent bands have been assigned. In the liquid state phenyl acetonitrile gives five broad bands with the 0, 0 band at 37844 cm^{-1}, while in the vapour state the 0, 0 band is at 38 010 cm^{-1}. In the solid state at −180° C the 0, 0 band shifts to 37 917 cm^{-1} and the excited electronic state is found to be split up into two components. Phenyl acetate in the liquid state yields four broad bands with the 0, 0 band at 37 554 cm^{-1}. The bands do not seem to undergo any change with changes of state except that the bands become a little sharper at the low temperature. Phenyl salicylate in the liquid state gives a very broad band with the absorption edge on the longer wavelength side at 31 306 cm^{-1} taken as the 0, 0 band. The 0, 0 band due to the vapour state has been found at 36 342 cm^{-1}. Thus major change is found to occur on the liquefaction of vapour. In the solid state at −180° C the spectrum gives four narrower bands with the 0, 0 band at 31 046 cm^{-1}. The liquid state of monomeric styrene yields five broad bands with the 0, 0 band at 34 228 cm^{-1} while that for the vapour state is at 34 761 cm^{-1}. In the solid state at −180° C, the 0, 0 band shifts to 34 215 cm^{-1} and the excited electronic state is found to be split up into two components giving rise to thirteen bands. It has been suggested that two types of molecules formed by two types of associated groups of molecules in the crystal may give rise to the splitting of electronic energy level. A.

535.343

247. ULTRAVIOLET ABSORPTION SPECTRA OF PHENOL, o-BROMOPHENOL AND DIPHENYL ETHER IN DIFFERENT STATES. S.B.Banerjee.
Indian J. Phys., Vol. 30, No. 7, 353-62 (July, 1956).

The ultraviolet absorption spectra of phenol, o-bromophenol and diphenyl ether in the different states have been studied. In the spectra of phenol and o-bromophenol the main shifts in the ν_0-bands occur with the liquefaction of the vapour while with the solidification of the liquids and cooling to −180° C practically no further displacements of the ν_0-bands take place. It has been concluded that for both these compounds the molecules get associated in the liquid state and the strength of the virtual bond remains unaltered even when the liquids are solidified and cooled to −180° C. The changes observed in the case of o-bromophenol with change of state are different from those for o-chlorophenol reported by previous workers. As the crystal structures of the compounds are expected to be the same it is pointed out that the lattice field is not mainly responsible for the changes observed in these two cases and that the difference in the behaviour of the molecules arises from the difference in the chemical affinity of the chlorine and bromine atoms. In the case of diphenol ether in the vapour state the absorption spectrum was found to consist of two overlapping series of bands, the displacement of one series from the other being 242 cm^{-1}, while in the solid state only one series is observed. This is explained by assuming the presence of two types of molecules in the vapour state owing to freedom of rotation about the C—O bonds. A.

535.343

248. ANALYSIS OF THE ABSORPTION AND FLUORESCENCE SPECTRA OF URANYL SALTS. I. URANYL ACETATE (ABSORPTION). V.Ramakrishna Rao and K.V.Narasimham.
Indian J. Phys., Vol. 30, No. 7, 334-47 (July, 1956).

The absorption spectrum of uranyl acetate was analysed as consisting of two systems involving two transitions from two excited states to a common ground state. The separation between these two excited states was found to be ν 1839 cm^{-1} or 0.228 eV. System I was explained on the basis of a (0, 0) band at ν 20 589 cm^{-1} and two upper state fundamentals 735 and 36 cm^{-1} and three lower state fundamentals 856, 210 and 30 cm^{-1}. System II was explained on the basis of a (0, 0) band at ν 22 428 cm^{-1} and the upper state fundamentals 711 and 212 cm^{-1} and the ground state fundamentals 841 and 228 cm^{-1}. A.

535.343

249. INFRARED SPECTRUM OF DIGERMANE; ν_5 AND ν_7 BANDS. D.A.Dows and R.M.Hexter.
J. chem. Phys., Vol. 24, No. 5, 1117-18 (May, 1956).

Some of the rotational fine structure of the Ge—H stretching motions observed (Abstr. 4314/1956) in the infrared spectrum of Ge_2H_6 have been resolved using a Merton—N.P.L. replica grating. G.I.W.Llewelyn

535.343 : 539.213 : 666

250. INFRA-RED REFLECTION SPECTRA OF GLASSES. P.E.Jellyman and J.P.Procter.
J. Soc. Glass Technol., Vol. 39, 173T-192T (Aug., 1955).

The use of infrared reflection measurements for studying the structure of glasses is discussed. The positions of the peaks in the spectral reflection curves indicate the vibrational frequencies of the structural linkages present. Measurements have been made of a number of commercial glasses, fused silica, fused boric oxide and several series of experimental glasses comprising binary silicates, binary borates and sodium borosilicates. Spectral reflection curves for the glasses are presented, and assignments of the observed reflection peaks to structural linkages are made and are listed in tabular form. There is support for the existing hypothesis concerning the co-ordination of boron in sodium borate glasses. In the borosilicate glasses investigated it appears that all the boron can be tetrahedrally co-ordinated, provided that there is sufficient Na_2O and SiO_2 present; B-O-Si linkages are formed in preference to B-O-B linkages; additional oxygen atoms from the Na_2O associate with the boron atoms in preference to the silicon atoms. Attention is drawn to the effects of changes in composition involving the replacement of one metallic oxide by another. Thus, for example, BaO and Na_2O appear to play similar roles as constituents of binary borate glasses, but different roles in barium crown types of glass. PbO and Na_2O play different roles in binary silicate glasses. A.

535.343

251. INFRARED SPECTRA OF TRIMETHYLHYDRAZINE [1] AND ITS OXIDATION PRODUCTS [2]. A.L.Olsen and H.W.Kruse.
J. chem. Phys., Vol. 24, No. 5, 1106-7 (May, 1956).

Absorption curves for 2-15μ are given for 1 and 2. Previously published curves for 1 correspond fairly well with the present curve for 2, suggesting that in previous measurements the specimen was oxidized. G.F.Lothian

535.343

252. INFRARED SPECTRA OF POLYETHYLENE AND LONG CHAIN n-PARAFFINS. E.E.Ferguson.
J. chem. Phys., Vol. 24, No. 5, 1115 (May, 1956).

Recorded infrared results are discussed and interpretations suggested. G.I.W.Llewelyn

535.343

253. INFRARED SPECTRUM OF METHYL ISOCYANIDE. R.L.Williams.
J. chem. Phys., Vol. 25, No. 4, 656-60 (Oct., 1956).

The spectrum of the vapour has been remeasured with medium resolving power from 1.7-10μ and in the far-infrared region around 38μ. From these observations it has been possible to obtain unequivocally the three degenerate fundamental vibration frequencies ν_6, ν_7 and ν_8, and the symmetric frequency ν_3. Thermodynamic properties are calculated for the molecule. In addition the spectrum of acetonitrile vapour has been remeasured around 6μ with slightly increased resolving power and the ν_3 and ν_6 fundamental frequencies obtained. A.

535.343

254. THE MICROWAVE SPECTRUM OF 1, 1, 1-TRICHLORETHANE. W.Zeil.
Z. Naturforsch., Vol. 11a, No. 8, 677-8 (Aug., 1956). In German.

The J_{4-5} rotational transition of CH_3CCl_3 was observed as a broad unresolved line at 23 735 Mc/s. D.H.Whiffen

535.343

255. MICROWAVE SPECTRUM OF THE C_2H_5Cl MOLECULE. A.I.Barchukov, T.M.Minaeva and A.M.Prokhorov.

Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 892 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 760 (July, 1956).

Additional transitions 0_{00}-1_{01} and 1_{01}-2_{02} have been observed in C_2H_5Cl from which A = 30 940 ± 200 Mc/s for Cl^{35} molecule. See also Abstr. 10053 (1954). D.H.Whiffen

535.345 : 541.183

256. OBSERVATION OF ANOMALOUS DISPERSION OF ADSORBED FILMS BY ELLIPSOMETRY. L.S.Bartell.
J. chem. Phys., Vol. 24, No. 5, 1108 (May, 1956).

The absorption spectra of films adsorbed on small areas of polished metal surfaces can be inferred from the changes in phase and amplitude suffered by elliptically polarized light on reflection from the surface. Rhodamin B adsorbed on a chromium surface is used in the region 400-700 m μ, to illustrate the technique. G.Allen

535.345

257. THE INFLUENCE OF TEMPERATURE ON THE CONTOUR OF THE CHARACTERISTIC OPTICAL ABSORPTION OF ALKALI HALIDES. W.Martienssen.
Nachr. Akad. Wiss. Göttingen, Math.-Phys. Kl. IIa, 1955, No. 11, 257-62. In German.

Measurements of the ultraviolet absorption bands of films of KBr, RbBr and KI show, with increasing temperatures, a shift of the max. to smaller frequencies (ν); in accordance with an expression due to Moglich and Rompe (Z. Phys., Vol. 119, 472, 1942) $1/\nu$ max. x $\partial\nu_{max}/\partial T$ is found proportional to the coefficient of expansion. The half-intensity width is found proportional to const. $+\int_0^T C_V\,dT$, where C_V is specific heat. G.F.Lothian

535.345.08

258. INCREASE AND DEFORMATION OF ABSORPTION CURVES. R.Kaiser.
Z. angew. Phys., Vol. 8, No. 9, 429-33 (Sept., 1956). In German.

Split-beam photometer measurements with samples of different absorption constants in the two beams are discussed for several cases. If the absorption curve for the comparison substance and the difference curve are known, a value V for the increase of the original absorption at a given wavelength can be calculated. Filters of constant transmission factor can be used for comparison, and will always result in an increase of the original absorption bands. It is proved that a band structure is most clearly recognized for 37% transmission. C.Turner

535.361.2

259. THE EFFECT OF EXTERNAL FACTORS UPON THE RESULTS OF MEASUREMENTS OF REFLECTED LIGHT. A.S.Toporets.
Optika i Spektrosk., Vol. 1, No. 1, 90-3 (1956). In Russian.

Experimental facts are adduced showing that the result of measurement of the coefficient of diffuse reflection depends both on the methods of illuminating the specimen and upon the method of observing. C.R.S.Manders

535.37

260. CRYSTALLINE MINERAL SUBSTANCES WITH INFRARED LUMINESCENT EMISSION. E.Grillot.
Acta phys. Hungar., Vol. 5, No. 4, 445-63 (1956). In French.

A review of the discovery and study of infrared luminescence in substances such as Cu_2O, CdS, CdSe and HgS. An energy band scheme is proposed for cuprous oxide based on luminescence and semiconduction data including exciton levels recently found in experiment. Other energy schemes are given for the levels in ZnS and CdS activated by silver and copper. G.F.J.Garlick

535.37 : 539.11

261. ATOMIC CENTRES OF NICKEL IN THE PHOSPHORS NaCl-Ni. M.L.Kats and B.Z.Semenov.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 3, 415-18 (1956). In Russian.

The method is one used previously for NaCl-Ag and NaCl-Cu (Abstr. 7588, 8328/1953, 313/1954). The absorption curves of phosphors prepared by electrochemical activation and also from a melt of NaCl + $NiCl_2$ are given and these have a single peak at 246 mμ. When the phosphors are irradiated by X-rays the 246 mμ peak disappears and peaks at 216, 279, 310, 350 and 465 mμ appear. The 465 mμ peak which is the strongest is removed by irradiation with light of that wavelength. W.Bardsley

535.37

262. NATURE OF THE CONCENTRATION EFFECTS IN SOLUTIONS OF ACRIDINE COMPOUNDS. L.V.Levshin.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 2, 228-31 (1956). In Russian.

Further evidence from luminescence spectra is adduced in support of the theory that the concentration and particularly pH-change effects on spectra and other physical properties of solutions of many acridine compounds are due not to resonance migration of the energy of excitation, but to the presence of different modifications of the compounds under investigation. The luminescence spectra of the practically pure two forms of 3 : 6-diaminoacridine have been obtained by change of the pH. R.C.Murray

535.37

263. TWO TYPES OF LUMINESCENCE SPECTRUM OF RARE EARTHS IN ARTIFICIAL FLUORITE CRYSTALS. I.V.Stepanov and P.P.Feofilov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 615-18 (1956). In Russian.

CaF_2 crystals with one of the following activators: Eu, Pr, Sm, Gd, Tb, Dy, Ho, Er, and Tu were found to show different spectra when prepared under oxidizing or reducing conditions. These spectra appeared to some extent related. The difference was ascribed to differences in the types of charge compensation. C.H.L.Goodman

535.37

264. LUMINESCENCE SPECTRA OF CRYSTALS OF CERTAIN IODIDES. V.A.Arkhangel'skaya and P.P.Feofilov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 803-5 (1956). In Russian.

Narrow bands have recently been observed in the absorption spectra of sundry crystalline oxides and salts, at liquid air temperatures, near to the long-wave edge of the fundamental absorption band. The present paper describes analogous narrow bands in the emission spectra of strongly cooled iodides of Hg, Pb and Ag at wavelengths but a few angstroms greater than the absorption bands. Both the distance between the emission bands and their width increase at longer wavelengths. C.R.S.Manders

535.37

265. INFRA-RED LUMINESCENCE OF ZINC AND CADMIUM SULPHIDE PHOSPHORS. P.F.Browne.
J. Electronics, Vol. 2, No. 1, 1-16 (July, 1956).

New luminescence emission bands have been found in the infrared region at 1.8 μ for cadmium sulphide phosphors. The emission is analogous to that recently found for zinc sulphide phosphors at 1.6 μ. A systematic study has been made of the infrared emission in a large number of zinc sulphide, zinc–cadmium sulphide and cadmium sulphide phosphors. It is excited by raising electrons from the valence band of the phosphor lattice into the ground states of the normal luminescence centres. The latter are either empty in the normal state or must first be emptied by suitable excitation giving rise to the well-known visible and near visible luminescence of these phosphors. The return of electrons to the valence band gives rise to the infrared emission. The excitation spectra for the infrared emission correspond to the quenching spectra for the visible luminescence and for the photoconduction of the above phosphors. A new infrared stimulation band of the visible emission of ZnS has been found at about 2.55 μ, which may well correspond to the single thermal glow peak of these phosphors. A.

535.37

266. COMPARISON OF THE THEORY OF THE LUMINESCENCE OF SOLID BODIES WITH EXPERIMENT. M.A.Krivoglaz.
Optika i Spektrosk, Vol. 1, No. 1, 54-65 (1956). In Russian.

A comparison with experiment is made of four theoretical expressions, obtained by Pekar, for the form and temperature variation of spectral curves, and also of formulae derived by the author for the probability of thermal transitions. It is considered by the author that theory is fully supported by experimental results. C.R.S.Manders

535.37

267. NATURE OF THE LOSSES OF LUMINESCENCE OF THE PHOSPHOR ZnS-Cu, Co IN THE REGION WHERE THE OUTPUT IS INDEPENDENT OF THE INTENSITY OF THE

EXCITING LIGHT. V.V.Antonov-Romanovskiĭ and L.A.Vinokurov.
Optika i Spektrsk., Vol. 1, No. 1, 66-70 (1956). In Russian.

It was shown by the authors and M.N.Alentsev (Dokl. Akad. Nauk SSSR, Vol. 94, No. 6, 1133, 1954) that the quantum output of luminescence of the phosphor ZnS-Cu depends upon the intensity, E, of the exciting light. Output is constant only for medium values of E and outside this plateau region output falls for both increasing and decreasing values of E. In the present paper it is shown that the basic cause of lowering of luminescent output of the phosphor ZnS-Cu with introduction of the killer Co are the non-radiative transitions associated with the movement of "holes" in the filled zone. C.R.S.Manders

535.37

268. KINETICS OF THE LUMINOSITY OF THE PHOSPHOR ZnS-Cu, Co IN THE REGION WHERE THE OUTPUT IN INDEPENDENT OF THE INTENSITY OF THE EXCITING LIGHT. V.V.Antonov-Romanovskiĭ and L.A.Vinokurov.
Optika i Spektrosk., Vol. 1, No. 1, 71-6 (1956). In Russian.

Luminosity curves of the phosphor ZnS-Cu, Co show a region where output of illumination in independent of the intensity of the exciting light. Inequalities of the total light over the plateau region are shown in the paper to arise from a change, while glowing, of the distribution of electrons and "holes" with respect to the capture levels of a particular depth. An estimate is also made of the activation energy of a killing process and of the energy of localization of electrons at the same deep levels according to the temperature shifts of the region of constancy of output of illumination. C.R.S.Manders

535.37

269. SPECTRA AND OUTPUT OF ANTI-STOKES AND STOKES FLUORESCENCE OF THE VAPOURS OF AROMATIC COMPOUNDS. B.S.Neporent and N.A.Borisevich.
Optika i Spektrosk., Vol. 1, No. 2, 143-54 (1956). In Russian.

Using vapours and solutions of various substituted phthalimides at various temperatures and vapour pressures, spectra are observed and absolute values of quantum fluorescence output measured, when excited in a broad region of the spectrum including the anti-Stokes frequency. In certain cases the output from vapours exceeds that from solutions. It is established that any change of output is accompanied by a small but definite change of form of the fluorescence spectrum. 25 refs., mainly Russian. C.R.S.Manders

535.37

270. THE ACTIVATION OF CdS CRYSTALS. K.T.Wilke.
Z. phys. Chem. (Leipzig), Vol. 205, No. 1-2, 73-7 (Oct., 1955). In German.

Comparison experiments on the activation processes are made for cadmium sulphide phosphors produced by evaporating a mixture of CdS and activator sulphide to form crystals by vapour deposition and those produced by diffusion of the activator into the CdS. Higher activator contents occur in the latter method. A discussion of the results is given in terms of the sublimation and dissociation temperatures of the activator sulphides and the ionic sizes of the activators used (Cu and Ag). G.F.J.Garlick

535.371

271. ON THE DEPENDENCE OF THE INTENSITY OF FLUORESCENCE OF FROZEN p-CHLOROTOLUENE ON THE WAVELENGTH OF THE EXCITING RADIATION. D.C.Biswas.
Indian J. Phys., Vol. 30, No. 5, 255-7 (May, 1956).

The dependence of the intensity of fluorescence of frozen p-chlorotoluene on the wavelength of the exciting radiation is investigated. It is observed that the group of Hg lines at 3650 A, and other lines of shorter wavelength, are responsible for the production of this fluorescence spectrum. A.

535.371

272. SELF-ACTIVATION AND SELF-COACTIVATION IN ZINC SULFIDE PHOSPHORS. J.S.Prener and F.E.Williams.
J. chem. Phys., Vol. 25, No. 2, 361 (Aug., 1956).

Self-activation is interpreted as being essentially similar to impurity-activation in which acceptor (activator, e.g. Cu) and donor (coactivator, e.g. Cl) atoms pair to form the luminescent centres. A Zn vacancy can accept electrons; together with one donor as a nearest neighbour it is electrically similar to a Cu atom at a Zn site. Interaction with a further donor, a second or third nearest neighbour, then gives the luminescent centre. A similar self-coactivation effect is predicted. Thus a S vacancy associated with a nearest-neighbour acceptor is electrically similar to a Cl atom at a S site, and so is a coactivator. Such self-activation and self-coactivation may be of importance for edge emission. C.H.L.Goodman

535.371

273. THE MEASUREMENT OF ABSOLUTE QUANTUM EFFICIENCIES OF FLUORESCENCE. W.H.Melhuish.
New Zealand J. Sci. Technol. B, Vol. 37, No. 2, 142-9 (Sept., 1955).

The absolute quantum efficiencies of fluorescence of solutions of some organic substances have been measured. The number of quanta absorbed and emitted by the solutions were measured with a fluorescent solution in combination with a photomultiplier, a device whose response depends on the number of quanta absorbed, irrespective of their energy. The fluorescent solution used was rhodamin B in glycerol. The spectral response of this fluorescer-photomultiplier combination was tested with quanta selected from a tungsten lamp operated at a known colour temperature and found to be very nearly independent of the energy of the quanta from 350 to 540 mμ. A.

535.372

274. FLUORESCENCE SPECTRUM OF Am^{+3} IN $LaCl_3$. D.M.Gruen, J.G.Conway, R.D.McLaughlin and B.B.Cunningham.
J. chem. Phys., Vol. 24, No. 5, 1115-16 (May, 1956).

The emission spectrum of Am^{+3} ions as impurity in single crystals of $LaCl_3$ is measured at different temperatures in a study of 5f electron transitions analogous to 4f electron transitions in the rare earths. Differences are observed between the spectrum for Am^{+3} and its analogue Eu^{+3}. G.F.J.Garlick

535.372 : 535.343

275. ELECTRONIC SPECTRA OF POLYACETYLENES. M.Beer.
J. chem. Phys., Vol. 25, No. 4, 745-50 (Oct., 1956).

The low-temperature emission spectra in rigid glass solutions of several substituted polyacetylenes have been investigated. All the compounds phosphoresced with decay lifetimes ranging from 0.01 to 0.3 sec. None of the compounds with less than four triple bonds fluoresced except diphenyl acetylene. All compounds with four triple bonds did fluoresce. An explanation is offered for this phenomenon. Some new absorption measurements were made on dimethyl diacetylene, dimethyl triacetylene and dimethyl tetraacetylene. The polarization of the transition between 32 000 and 40 000 cm^{-1} in a single crystal of dimethyl triacetylene was found to be along the axis of the molecules. These results and those of previous investigators show that the energy level arrays of the molecules can be related and that they vary systematically as the number of triple bonds increases. This in accord with expectation on the basis of simple molecular orbital theory. An assignment of the symmetries of the electronic wave-functions is proposed on the basis of the positons and intensities of the bands. A.

535.375.5

276. HIGH RESOLUTION RAMAN SPECTROSCOPY OF GASES. VII. ROTATIONAL SPECTRA OF s-TRIAZINE AND s-TRIAZINE-d_3. J.E.Lancaster and B.P.Stoicheff.
Canad. J. Phys., Vol. 34, No. 10, 1016-21 (Oct., 1956).

For Pt VI, see Abstr. 5620 (1956). The pure rotational Raman spectra of s-triazine ($C_3H_3N_3$) and s-triazine-d_3 ($C_3D_3N_3$) vapour were photographed in the second order of a 21 ft grating spectrograph. The rotational constants were found to be $B_0(C_3H_3N_3) = 0.2146_0 \pm 0.000\,08\ cm^{-1}$ and $B_0(C_3D_3N_3) = 0.1935_8 \pm 0.0001_5\ cm^{-1}$. These values, together with the assumption that the molecule is planar and has a CH bond length of 1.084 A, give the following values for the structural parameters: $r_0(CN) = 1.338 \pm 0.001$ A, $\angle NCN = 127^0$, and $\angle CNC = 113^0$. A.

535.375.5 : 539.13

277. ON THE INFLUENCE OF INTERMOLECULAR INTERACTIONS ON THE INTENSITIES OF LINES IN THE COMBINATION SCATTERING [RAMAN EFFECT] OF THE FIRST ORDER. Ya.S.Bobovich and V.M.Pivovarov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 607-10 (1956). In Russian.

The intensities are measured for the Raman lines of the symmetrical -NO_2 vibration of p-nitrotoluene, p-nitrophenol

and p-nitroaniline in acetone and benzene solutions relative to the 1380 cm^{-1} shifts of naphthalene as standard intensity. The ratios are all greater when excited with 4358 A radiation than with 5461 A, since the former is nearer the electronic absorption band of the nitrocompounds. For p-nitrotoluene and p-nitrophenol the intensity is roughly proportional to the concentration, but there is an anomaly with p-nitroaniline for which a solution of half strength gives a slightly stronger line.
D.H.Whiffen

535.375.5

278. AN OPTICAL METHOD OF STUDYING HYDROCARBONS. RAMAN SPECTRA OF UNSATURATED HYDROCARBONS. S.V.Markova, P.A.Bazhulin and M.M.Sushchinskiĭ.
Optika i Spektrosk., Vol. 1, No. 1, 41-53 (1956). In Russian.

The present paper is in continuation of a series devoted to the study of the Raman spectra of individual hydrocarbons. The paper gives results of investigations of sixteen unsaturated hydrocarbons. Line intensities were determined photometrically. There is a discussion of the connection between the Raman spectrum and the structure of the molecule. 22 refs.
C.R.S.Manders

535.375.54/55

279. RAMAN SPECTRA OF LIQUID AND SOLID HYDROGEN. E.J.Allin, T.Feldman and H.L.Welsh.
J. chem. Phys., Vol. 24, No. 5, 1116-17 (May, 1956).

Observed Raman frequencies of normal and pure para-H_2 are tabulated. The band origin ν_0, and the rotational constants B_0, B and D of H_2 have been calculated from the observed data. The constants for liquid and solid H_2 are identical but ν_0 is rather smaller than that of gaseous H_2.
G.I.W.Llewelyn

535.376

280. THEORY OF ELECTROLUMINESCENCE. E.Nagy.
Acta phys. Hungar., Vol. 6, No. 1, 153-6 (1956).

A new theory is proposed, allowing for interactions between conduction electrons and lattice defects, and assuming a Maxwell–Boltzmann electron distribution at a higher temperature than the lattice. An expression for the field dependence of electroluminescence is derived and compared with existing experimental data on ZnS.
J.B.Birks

535.376

281. LUMINESCENCE OF ICE SUBJECTED TO IONISING RADIATION. J.A.Ghormley.
J. chem. Phys., Vol. 24, No. 5, 1111-12 (May, 1956).

535.39 : 539.23

282. ON THE COMPLEX VALUE OF THE LIGHT REFLECTED BY A THIN FILM. M.Perrot, J.P.David, G.Peri, J.Robert and J.Tortasa.
C.R. Acad. Sci. (Paris), Vol. 243, No. 4, 367-70 (July 23, 1956). In French.

The complex reflection coefficient of a homogeneous thin film is a function of the film thickness and the optical constants of the material of which it is composed. In the case of very thin films with a granular structure, the optical constants may vary due to the limitation on electronic mean free path imposed by the small granule size, and an "apparent" thickness must be introduced to allow for the structure. It is shown how families of curves in which the complex coefficient is plotted on an Argand diagram for series of values of optical constants and for different thicknesses can be used to separate effects of thickness and optical constant changes in studying the variation of optical properties with thickness.
D.G.Avery

535.39 : 535.41 : 539.23

283. COMPUTATIONS IN THIN FILM OPTICS.
W.Weinstein.
Vacuum, Vol. 4, No. 1, 3-19 (Jan., 1954; publ. June, 1956).

A survey is given of computing methods in thin film optics and the merits of different schemes for different purposes are discussed. Some design techniques for multi-layer filters are described.
A.

535.39

284. OPTICAL SEMI-REFLECTORS. SUITABLE METHODS AND MATERIALS. K.H.Spring and N.P.Barton.
Vacuum, Vol. 4, No. 1, 20-5 (Jan., 1954; publ. June, 1956).

The optical properties and methods of preparation of various materials—metals, semi-metals and dielectrics—are surveyed which may be used as optical semi-reflectors. Specific suggestions are made for obtaining any desired reflectance.
A.

535.39 : 535.41

285. SOME "BLACK" INTERFERENCE REFLECTORS. K.H.Spring and N.P.Barton.
Vacuum, Vol. 4, No. 1, 26-9 (Jan., 1954; publ. June, 1956).

The construction of various types of interference mirror, designed to reflect near infrared and to absorb visible radiation, is described. The spectral discrimination of the simple type of interference mirror may be enhanced by taking advantage of the optical properties of gold or germanium.
A.

535.393

286. THE QUESTION OF PHASE RELATIONSHIPS AT THE BOUNDARY OF DIELECTRIC AND METAL. I.N.Shklyarevskiĭ.
Zh. tekh. Fiz., Vol. 26, No. 2, 333-42 (1956). In Russian.

It is alleged that in the majority of published work false values are given for the magnitude and sign of the phase angle of reflection and transmission coefficients at inter-faces. Correct values are given. Measurements are made of the dispersion in the phase jump on reflection between air and silver. A calculation is made of the dispersion in the same quantity for a thin sheet. A new method is described for an interferometric method of determining the optical constants of a metal.
S.C.Dunn

535.41

287. NOTE CONCERNING MULTIPLE REFLECTIONS WITHIN ABSORBING THIN FILMS. P.H.Berning.
J. Opt. Soc. Amer., Vol. 46, No. 10, 779-82 (Oct., 1956).

It is shown that the generalized multiple beam model as it is currently formulated breaks down under certain conditions when dealing with multilayer film combinations containing absorbing elements. An example is given by way of illustration.
A.

535.41 : 535.345

288. EFFECT OF ANTIREFLECTION FILMS ON COLOR IN OPTICAL INSTRUMENTS. A.E.Murray.
J. Opt. Soc. Amer., Vol. 46, No. 10, 790-6 (Oct., 1956).

Reports a numerical investigation of the effect of antireflection films on transmitted colour in optical instruments consisting of a number of coated surfaces. Three film thicknesses, six glasses of refractive index ranging from 1.5110 to 1.7200, and surface multiplicities from 1 to 64 are reported. Colorimetric data for the films in reflection and transmission are tabulated and the leading results summarized.
A.

535.41 : 539.234

289. THE RAPID ASSESSMENT OF MULTILAYER DIELECTRIC HIGH-REFLECTORS. S.Tolansky.
Lab. Pract., Vol. 4, No. 9, 361-4 (Sept., 1955).

Multilayer dielectric high reflectors, which are finding frequent use in precision interferometry, are difficult to make with their reflecting maxima at a critically desired wavelength. It is shown that the wavelength peak, the approximate reflectivity and the approximate absorption can all be rapidly visually assessed. Two simultaneously prepared multilayers are pressed close together and with a constant deviation spectroscope fringes of equal chromatic order are examined. These show, by their sharpness peak at which wavelength the reflectivity is a maximum, and from the actual fringe width reflectivity can be assessed. If fringes of equal chromatic order in reflection are examined, the fringe visibility permits a rough assessment of absorption to be made also.
S.Tolansky

535.417 : 531.717.1

290. MODIFIED METHOD OF FIZEAU FRINGES FOR THICKNESS MEASUREMENTS. H.Osterberg and D.LaMarre.
J. Opt. Soc. Amer., Vol. 46, No. 10, 777-8 (Oct., 1956).

The exit slit of a monochromator is focused upon a pinhole located in the first focal plane of an objective utilized for viewing the multiple-beam fringes formed by inter-reflections between two inclined surfaces, one of which is stepped. The step is focused into the plane of an eyepiece whose reticule contains a pair of parallel lines between which successive fringes are set and measured by rotation of the wavelength drum. The preferred, and possibly novel, method of interpreting the observations is discussed.
A.

535.417 : 534.15

291. CALIBRATION OF VIBRATION PICK-UPS AT HIGH FREQUENCIES USING A MICHELSON INTERFEROMETER. S.M.Davies.
Nature (London), Vol. 178, 161 (July 21, 1956).

A Michelson interferometer has been used for calibrating a BaTi accelerometer over the frequency range 500 c/s to 10 kc/s at vibration amplitudes of the order of 10^{-6} in. The interferometer is mounted in a vertical plane and one of the two mutually perpendicular mirrors is attached to a block carrying the pick-up and mounted on the vibrator armature. The amplitude of vibration is slowly increased and the appearance and disappearance of the fringes, corresponding to definite amplitudes of vibration, are noted. For light of 5461 A, the first three amplitudes are approx. 4.1, 9.4 and 14.8 x 10^{-6} in. H.J.H.Starks

535.417 : 531.7

292. INTERFEROMETRIC EVALUATION OF THICKNESS AND SHAPE USING THE TWO-SIDED TECHNIQUE. G.Schulz.
Optik, Vol. 13, No. 9, 404-10 (1956). In German.

A method is described for measuring the thickness of transparent or opaque thin films using a Michelson interferometer type of arrangement (interference microscope) with incident illumination. A knowledge of the refractive index is not needed. The interference pictures obtained are sharpened up by the equidensity photographic procedure. Fringe patterns from the two sides are copied on to one plate and this offers information about thickness variations from point to point. A CdS microcrystal is examined as an example. S.Tolansky

535.417 : 681.42

293. A NON-CONTACT INTERFERENCE METHOD OF CHECKING SPHERICAL LENS SURFACES. Yu.V.Kolomiĭtsov and I.I.Dukhopel.
Optika i Spektrosk, Vol. 1, No. 1, 94-101 (1956). In Russian.

Superposition of a test piece when checking spherical surfaces of lenses is a method having certain shortcomings. The paper describes an equipment in which the lens is supported clear of a test surface. A system of interference rings is observed from which it is possible to determine with high precision not only deviations of the radius of curvature of the surface from the nominal value but also local errors of the surface Illustrated with diagrams and photographs. C.R.S.Manders

535.417

294. A NEW TYPE OF INTERFERENCE ETALON. K.I.Tarasov.
Optika i Spektrosk., Vol. 1, No. 1, 103-4 (1956). In Russian.

The apparatus is a modification of the Fabry—Perot etalon in which the plane parallel reflector plates are covered on both sides with interference films of dielectric so that these reflectors individually form Fabry—Perot etalons. The plane parallel layer of air between the plates forms a third intermediate interference space. The interference picture observed in such a triple etalon is substantially different from the simple fringe system of a normal Fabry—Perot instrument recalling somewhat what is seen with the multiplex version. The reflection coefficient of each of the glass plates has its maximum value for definite angles of inclination of the incident rays and for other angles it is close to zero. With change of angle incidence there is a complementary change of phase of the reflected ray and this, added to the phase difference of the interfering rays (determined by the air inter-layer), leads to much sharper interference rings and greater resolving power than in the normal Fabry—Perot instrument. Subsidiary maxima may be readily distinguished from line components for a change of pressure of the air inter-layer causes subsidiary maxima to remain in place whilst line components will move over the field of view. C.R.S.Manders

535.417

295. REFLECTING MULTI-DIELECTRIC LAYERS APPLIED TO THE FABRY—PEROT INTERFEROMETER. THEORETICAL AND EXPERIMENTAL STUDY OF REAL FILMS. P.Giacomo.
Rev. Opt., Vol. 35, No. 6, 317-54 (June, 1956). In French.

Full details are given for the preparation of multilayers suitable for the Fabry—Perot interferometer. Methods for thickness control are described in detail. Measurements are reported for transmissions and resolutions of various film combinations (up to 9 layers). The effect of deviations of film thickness from the theoretical $\lambda/4$ is computed. The effect of phase change at reflection is calculated. The case of absorbing films is also treated. Curves are given for transmission and resolution for an ideal instrument. The calculations show that the absorptions of the materials of the films are insufficient to account for observed behaviour. It is established that diffusion and scatter due to surface irregularities of the film leads to an apparent increase in absorption which leads to agreement with observation. S.Tolansky

535.417

296. ELECTRIC INTEGRATOR APPLIED TO INTERFEROMETRY. P.Croce, A.Laval and B.Sergent.
Rev. Opt., Vol. 35, No. 6, 359-63 (June, 1956). In French.

The system described can be used either in transmission or reflection. A beam of polarized light is passed through a Savart plate on to the surface under study, back through the Savart plate, through an analyser and then on to a photomultiplier cell. The object mechanically traverses across the field and an electronic integrating system is employed. In effect the reflected intensity is integrated. The surface requires to satisfy certain conditions before the technique can be applied. Thus the retardation must be between 50 and 230 mμ. Defects down to 35 μ wide can be studied. S.Tolansky

535.417

297. A SIMPLE TECHNIQUE FOR THE TOPOGRAPHICAL EVALUATION OF AN OPTICAL FLAT. R.Bünnagel.
Z. angew. Phys., Vol. 8, No. 9, 447-50 (Sept., 1956). In German.

A mercury surface is used as reference mirror. A geometrical method of deriving the topography of a nearly plane surface from the Fizeau fringe pattern is described. The limits of error are discussed. S.Tolansky

535.417 : 523.77

INTERFEROMETRIC MEASUREMENTS OF WAVELENGTHS. See Abstr. 43 and 44

535.42 : 534.21

298. DIFFRACTION OF LIGHT BY ULTRASONIC WAVES AT 300 Mc/s. B.Ramachandra Rao and J.Satyanarayana Murty.
Nature (London), Vol. 178, 160-1 (July 21, 1956).

The diffraction effects due to progressive waves in water have been studied to 300 Mc/s, and the velocity of sound calculated. The results show that there is no dispersion of ultrasonic velocity in water up to 300 Mc/s. R.W.Fish

535.43

299. METHOD OF DETERMINING AN INDEX OF SCATTERING OF LIGHT BY LARGE PARTICLES OF ARBITRARY SHAPE. E.O.Fedorova.
Svetotekhnika, 1955, No. 4, 17-19. In Russian.

Particles, in powder form, are dropped across a monochromatic polarized light beam in a vertical cylinder which is blackened inside. For very fine powders falling exceedingly slowly under gravity the cylindrical chamber is partially evacuated. The cylinder has a 170° slit at the level of the scattering area and a film is placed over it. The light scattered in any direction is measured by the blackening of the film in that direction. Curves are given for spherical particles of (i) methylmethacrylate, (ii) powdered glass and for (iii) powdered selenium. For (i) theoretical curves are also given; the agreement between theoretical and experimental results appears satisfactory. C.R.S.Manders

535.557 : 532.59

300. DOUBLE REFRACTION OF A LIQUID IN A DYNAMIC FIELD OF DISPLACEMENT WAVES. S.N.Pen'kov.
Optika i Spektrosk., Vol. 1, No. 1, 77-84 (1956). In Russian.

A method is worked out and described whereby it is possible to study quantitatively displacement waves in a liquid at sonic frequencies. The method is based upon a measurement of the double refraction arising in a displacement field. When applied to a study of castor oil at frequencies 208, 770, 1500, 5500 c/s the results agree with the classical theory due to Stokes and coincide with results predicted from measurements of double refraction in a stream of the same liquid. C.R.S.Manders

535.7

PHYSIOLOGICAL OPTICS. VISION. See under "Medical science. Human physiology". Decimal classification 612.84

535.8 : 681.4

301. SCANNING INTEGRATOR FOR PRODUCING SINUSOIDAL TEST OBJECTS. N.S.Kapany and J.N.Pike.
J. Opt. Soc. Amer., Vol. 46, No. 10, 867-74 (Oct., 1956).

An account is given of a simple system for producing a sinusoidal exposure distribution in time and space. A "scanning integrator" is used to scan square-topped periodic test objects, thereby presenting the desired exposure distribution to the lens system under test. The effects of various geometrical shapes of the entrance aperture of the scanning integrator on the exposure distribution are investigated. By such a direct scan, sine waves of opacity result on the recording film, which may then be employed for producing sinusoidal transmittance waves by a printing method. Direct sine waves of transmittance are also produced using a nonuniform Ronchi ruling. The simple setup used for this investigation is described, and the microdensitometer traces show that high quality sine wave test objects are obtainable. A.

535.822.9

302. TWO HOLOGRAM METHODS IN DIFFRACTION MICROSCOPY. G.L.Rogers.
Proc. Roy. Soc. Edinburgh A, Vol. 64, Pt II, 209-21 (1956).

The Bragg two-hologram method for eliminating the unwanted image in diffraction microscopy is here thoroughly examined. It is shown to be of general validity for objects containing both amplitude and phase-contrast terms. Other two-hologram methods are briefly discussed. In principle any two sufficiently distinct holograms may be used, but the Bragg 2 : 1 focal ratio is the simplest. The pair of holograms at $\pm f$ is also of interest, since it allows moderate degrees of phase-contrast and amplitude-contrast terms in the original object to be separated. A "three-wavelength" technique for obtaining the Bragg records is briefly outlined. A.

HEAT 536

536.2.083

303. MEASUREMENT OF THE ABSOLUTE THERMAL CONDUCTIVITY OF GASES UP TO 1100°C. K.Schäfer and F.W.Reiter.
Naturwissenschaften, Vol. 43, No. 13, 296-7 (1956). In German.

Thermal conductivity of argon is measured between 290 and 1112°C by a method of stationary heat flow. There are appreciable losses of heat by conduction through the solid parts of the apparatus and by radiation. These losses are determined by direct measurement; an accuracy of 1% is claimed for the corrected values of the thermal conductivity. Measurements are made along isobars; it appears, however, that the effect of the pressure on the coefficient of thermal conductivity is very small. This coefficient increases from 693 cal. cm^{-1} sec^{-1} deg^{-1} at 294° to 1211 at 1112°. It is found that the ratio of thermometric conductivity to viscosity is constant over a wide range of temperatures. R.Eisenschitz

536.21

304. HEAT CONDUCTION IN SEMI-INFINITE SOLID IN CONTACT WITH LINEARLY INCREASING MASS OF FLUID. C.C.Chao and J.H.Weiner.
Quart. appl. Math., Vol. 14, No. 2, 214-17 (July, 1956).

The problem of a semi-infinite solid in perfect contact with a well-stirred fluid whose mass is initially zero and increases linearly with time is considered. An example is the analysis of the filling stage of a casting process. The solution of the problem involves a differential equation having the Laplace transform parameter as independent variable. Numerical results are shown graphically. E.H.Dock

536.21

305. TRANSIENT HEAT CONDUCTION IN SOLIDS BOUNDED BY ORTHOGONAL COORDINATE SURFACES. M.G.Kogan.
Zh. tekh. Fiz., Vol. 26, No. 6, 1185-93 (1956). In Russian.

This is a discussion of the inhomogeneous equation of thermal conduction; a number of solutions are obtained. R.Eisenschitz

536.222

306. EXPERIMENTAL DETERMINATION OF THE THERMAL CONDUCTIVITY OF LIQUID OXYGEN. N.V.Tsederberg and D.L.Timrot.
Zh. tekh. Fiz., Vol. 26, No. 8, 1849-56 (1956). In Russian.

The thermal conductivity of oxygen is measured along two supercritcal isobars (100 and 60 atm) between −190 and +25°C. A steady-state method is used; heat is supplied by an electrically heated wire and flows in radial direction to the wall of a capillary across a gap of 0.21 mm. In this apparatus the danger of convection is eliminated; end effects and other sources of error are carefully taken into account. Results published by previous workers are critically discussed. It appears that at low temperatures the coefficient of thermal conductivity becomes almost independent of the pressure. Results of the present work are shown in graphs; a table is added in which smoothed values of the thermal conductivity are compiled between 1 and 100 atm and −200 and +40°C. R.Eisenschitz

536.23

307. THE THERMAL CONDUCTIVITY OF GASES AND VAPOURS. C.Sălceanu and S.Bojin.
C.R.Acad. Sci. (Paris), Vol. 243, No. 3, 237-9 (July 16, 1956). In French.

A hot-wire method is used and is briefly described. The results are obtained relatively to that for H_2 and figures are given for carbon dioxide, air, and an oxygen—hydrogen mixture. Wires of Cu, Ag, Ni, and Fe have been used, the diameter ranging from 0.05-0.2 mm. Plots of results at different temperatures meet at a point on the negative side of the axis. This intercept is considered to be due to heat losses from the ends of the wire and depends on the history of the wire as well as on its conductivity. E.H.Dock

536.24

308. HEAT LOSS FROM A PARTIALLY INSULATED SOLID BODY. J. Gillis.
J. Phys. Soc. Japan, Vol. 11, No. 9, 993-1003 (Sept., 1956).

Investigates the problem of a thermally conducting solid, initially at a uniform temperature, part of whose surface is insulated. The uninsulated part of the surface radiates heat into a medium at zero temperature. In particular the case is considered in which the insulated and uninsulated regions cannot be represented as distinct coordinate surfaces in variables in terms of which the conduction equation is separable. An integral equation is derived for the boundary values of the temperature and solutions of this equation are obtained in two special cases, viz. a semi-infinite solid insulated except for a single infinite strip, and the same solid insulated except for two equal parallel infinite strips at a considerable distance apart. In both cases it is shown that the solution can be represented for large values of the time t, by a series of inverse powers of log t. In case the strips are very narrow a closed expression is obtained which approximate the sums of the series. A.

536.33.08

309. BOLOMETERS OF ALLOYS OF BISMUTH AND LEAD. M.N.Markov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 428-31 (1956). In Russian.

Describes the experiments with different alloys and a bolometer of 99.4% Bi and 0.6% Pb with a sensitivity of 4.5×10^{-11} Watts. J.M.Hough

536.33 : 538.56 : 535.23

RADIATION FROM A SOURCE IN A GAS-FILLED BODY. See Abstr. 210

536.413 : 548.7

310. THE THERMAL EXPANSION OF SODIUM CHLORIDE AND SOME OTHER ALKALI HALIDES AT HIGH TEMPERATURES. H.F.Fischmeister.
Acta cryst., Vol. 9, Pt 5, 416-20 (May, 1956).

X-ray measurements of thermal expansion of NaCl up to the melting point are reported. Within experimental error, the expansion of the lattice agrees with the macroscopic dilatation, and it is shown that the number of lattice defects present at the melting point cannot be expected to cause a positively detectable difference between them. The observed non-

linearity of the thermal expansion of the alkali halides is shown to be in accord with established lattice-dynamical theory and not to be caused by lattice defects. A.

536.413.2.08

311. AN INSTRUMENT FOR THE CONTINUOUS MEASUREMENT OF SHRINKAGE OF TEXTILE YARNS.
R.A.E.Ellis, K.W.Hillier and A.B.Thompson.
J. sci. Instrum., Vol. 33, No. 10, 394-5 (Oct., 1956).

The yarn is fed from a bobbin at a fixed rate into a hot-air treatment chamber. After passing over a tensioning device it is withdrawn at a variable rate so that the tension and length of yarn in the chamber (and therefore the time of heat treatment) are held substantially constant. The tension is known and adjustable. The shrinkage under these controlled conditions is derived from the ratio of input to output rates, and is displayed numerically as a percentage. After a bobbin has been knotted in and the instrument started, a fixed length of yarn is tested automatically. A.

536.413.3

312. MEASUREMENTS OF VOLUME EXPANSION COEFFICIENTS OF CRYSTALS BY FLOTATION METHOD.
B.P.Konstantinov and G.Ya.Rŷskin.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 455-7 (1956). In Russian.

The method is based on accurate measurements of density difference between the crystal and a float (or another crystal) of known expansion coefficient. Measurements are made in two liquids at different temperatures. Working formula is derived and an estimate made of the accuracy of the method. Error of a single result should not exceed 1%. J.Adam

536.421.1 : 537.311.33

313. THE MELTING POINTS OF GALLIUM AND INDIUM ANTIMONIDE. J.Bednář and K.Šmirous.
Czech. J. Phys., Vol. 5, No. 4, 546 (Dec., 1955). In German.

For samples with impurity contents about $2\text{-}3 \times 10^{16} cm^{-3}$ the melting points were found to be for GaSb = 712.1 ± 0.3°C, for InSb = 525.2 ± 0.3°C. E.P.Wohlfarth

536.423.1 : 539.172.4

314. THE VOLATILIZATION OF PLUTONIUM FROM NEUTRON-IRRADIATED URANIUM. D.E.McKenzie.
Canad. J. Chem., Vol. 34, No. 4, 515-22 (April, 1956).

The volatilization of plutonium from neutron-irradiated uranium has been examined at 1540°, 1650° and 1769°C. The observed rates of evaporation of plutonium have been compared with calculated rates based on the Langmuir equation and Raoult's law. Experimental and calculated results agree within the precision of the experimental measurements, indicating that the plutonium in neutron-irradiated uranium follows the ideal solution laws. A.

536.423.1

315. EVAPORATION OF LIQUIDS IN CONNECTED CAPILLARIES AND THE BASIC LAW OF MOISTURE MOVEMENT IN CAPILLARY-POROUS SOLIDS. V.K.Lebedeva.
Zh. tekh. Fiz., Vol. 26, No. 5, 1064-9 (1956). In Russian.

Describes experiments performed with capillary tubes and with porous bodies. Derives a theoretical relation for the temperature coefficient of diffusion in porous bodies and shows it agrees well with experiments. J.M.Hough

536.423.15 : 537.583 : 537.561

316. PLUTONIUM: EVAPORATION TESTS, IONISATION POTENTIAL AND ELECTRON EMISSION. R.H.V.M.Dawton and K.L.Wilkinson.
Atomic Energy Res. Establ. (Harwell) Rep. No. GP/R 1906, 6 pp. (1956).

Tests have been made on the evaporation of plutonium from crucibles of different materials in order to find the fraction which can be evaporated. The best crucible materials were found to be tungsten or tantalum. Graphite, either alone or coated internally with Al_2O_3 or BeO was unsatisfactory. By estimating the rate of effusion from the crucible the vapour pressure of plutonium was found to be 10^{-3} mm of Hg at 1450° ± 50°C. 7% of the plutonium atoms which struck a tungsten surface at 2600°C were ionized when the incident flux of neutrals was in the region of 10^{15} to 10^{16} atoms/cm²sec. Under the same conditions a measurement of the saturated electron and ion emission gave a value of 5.1 ± 0.5 eV for the ionization potential of plutonium. Tungsten and tantalum surfaces coated with plutonium gave electron emission comparable with that from thoriated tungsten. A.

536.423.15

317. VAPOR PRESSURE OF SEBACONITRILE.
M.H.Kaufman and A.G.Whittaker.
J. chem. Phys., Vol. 24, No. 5, 1104 (May, 1956).

Determined between 30 and 70°C using a piston manometer apparatus (Abstr. 7729/1955). The estimated accuracy is 1% and ΔH_{vap} = 20 kcal/mole. G.Allen

536.423.15.08 : 539.219

318. THE MEASUREMENT OF VAPOUR PRESSURES BY A MODIFIED DEW-POINT METHOD WITH PARTICULAR REFERENCE TO THE SYSTEM MERCURY-MAGNESIUM.
B.R.T.Frost and J.T.Maskrey.
Atomic Energy Res. Establ. (Harwell) Rep. No. M/R 1898, 8 pp. (1956).

A number of thermodynamic functions of the components of a binary alloy system can be derived from the measurement of the vapour pressure of the more volatile component. In the investigation described in this report three different of measurement of vapour pressure were examined before the dew-point method was selected as giving the most accurate results and being the simplest to operate. The dew-point was detected by the reaction of a photoelectric cell to a beam of light passing through a glass chamber containing the metal vapour. The apparatus was used to determine the vapour pressure of mercury over mercury-magnesium alloys and over ternary mercury-magnesium-lead alloys. Thermodynamic activities and partial molar functions were calculated from the vapour pressure data. A.

536.424.1 : 537.228

319. TRIPLE HYSTERESIS LOOPS AND THE FREE-ENERGY FUNCTION IN THE VICINITY OF THE 5°C TRANSITION IN $BaTiO_3$. E.J.Huibregtse and D.R.Young.
Phys. Rev., Vol. 103, No. 6, 1705-11 (Sept. 15, 1956).

The effect of an electric field on the transition between the orthorhombic and tetragonal states in single crystals of $BaTiO_3$ has been investigated. With zero bias the tetragonal to orthorhombic transition occurs near 5°C and the inverse transition at 11°C, exhibiting a temperature hysteresis of about 6°C. As expected, an external field in the direction of the polarization in the tetragonal state lowers both transition temperatures. Measurements show that the temperature depression varies linearly with the field. A strong field (> 20 kV/cm) can lower both transition temperatures below the 5°C transition at zero field. Thus at a constant temperature, in a small temperature range below 5°C, the crystal can be switched reversibly between the two states by means of an electric field. Since the spontaneous polarization is smaller in the orthorhombic state, this phenomenon can be displayed as a "triple loop" in the familiar polarization v. electric field hysteresis plot. The dielectric constant has been measured as a function of temperature, and as a function of field at fixed temperatures. Transitions between states are sharp whether the transition is produced by varying the temperature or the electric field, provided the faces are completely electroded. Numerical coefficients for various terms in the free-energy expansion for $BaTiO_3$, have been determined from certain of the experimenta measurements. Calculations for various physical properties based upon the free-energy expansion agree reasonably well with these properties determined experimentally. A.

536.462

320. BOUNDARY ZONE EFFECTS IN THE DETERMINATION OF TEMPERATURES OF LUMINOUS FLAMES.
F.Rössler and H.Pösch.
Optik, Vol. 13, No. 9, 411-32 (1956). In German.

The homogeneous temperature distribution previously assumed to obtain in a flame should be replaced, to get a better approach to reality, by a trapeze-formed temperature distribution with a fall or rise of temperature towards the edges. The consequent change of black body temperature, colour and true temperatures are calculated and applied to a premixed flame, a diffusion flame, and combustion in a bomb. The true temperatures worked out from the experimentally determined black and colour temperature by an earlier method are in unfavourable cases as much as 30% out because of the inhomogeneous temperature distribution. R.C.Murray

536.462

321. CALCULATION OF THE ENERGY RADIATED BY A FLAME AND MEASUREMENT OF THE TEMPERATURE OF

FLAMES BY OPTICAL METHODS FOR THE CASE OF NON-UNIFORM DISTRIBUTION OF TEMPERATURE AND EMISSIVE POWER. B.Baudin.
Rev. Opt., Vol. 35, No. 7, 381-95 (July, 1956). In French.

From general equations of radiation emitted by a luminous gas, an attempt was made to connect the temperature measured by optical means to the local temperature of gas. It is shown that the energy received by the pyrometer may be expressed as the product of an opacity coefficient and black body luminance, but the equivalent black body temperature is not simply connected to the gas temperature and depends specially on the emissive power of the flame even when distributions are geometrically similar. In most cases calculation cannot be carried out rigorously even by numerical integration. The only experimental data were obtained for total radiation whilst the measured radiation was not grey and so results are completely wrong because of very important "glass-house effects". In the special case of diffusion flames simple distribution laws are similar to speed distribution in a completely developed turbulent jet and the emitted radiation may be calculated. For small variations of temperature when the luminance law may be linear, it was shown that the measured temperature is independent of the chosen law and is always, according to direction, equal to or little less than the temperature of the point placed inside the flame at the third of its thickness. The case of a jet surrounded by a cold sheath may be discussed without any assumption as to the temperature of that sheath. A.

536.48 : 536.63

322. MEASUREMENT OF HEAT CAPACITY OF MICROSCOPIC PARTICLES AT LOW TEMPERATURES. W.F.Giauque.
Phys. Rev., Vol. 103, No. 6, 1607-9 (Sept. 15, 1956).

The problem of measuring the heat capacity of microscopic particles at temperatures up to a few degrees absolute is discussed. In order to avoid the heat effects of helium adsorption, it appears that such measurements must be made with the individual particles out of equilibrium with each other. In practice this restricts such investigations to paramagnetic substances which can be measured by the techniques of adiabatic demagnetization. A.

536.48 : 536.5.081

323. A NEW CALCULATION OF THE SATURATED VAPOUR PRESSURE OF LIQUID HELIUM FOR USE AS A TEMPERATURE SCALE. H.van Dijk and M.Durieux.
Physica, Vol. 22, No. 8, 760 (Aug., 1956).

Using previously known measurements the recalculation provides the pressure between 0.9 and 5.2 °K in steps of 0.001 deg. Up to 4.25° the error is estimated to be 0.002 deg. R.Eisenschitz

536.48

324. THE CHARACTER OF THE ROTON STATE IN LIQUID HELIUM. R.P.Feynman and M.Cohen.
Progr. theor. Phys., Vol. 14, No. 3, 261-3 (Sept., 1955).

The wave-function $\psi = \Sigma_i \exp(i\vec{k}.\vec{r}_i)\varphi$ of Abstr. 6569/1954 is refined to $\psi = \Sigma_i \exp[i\vec{k}.\vec{r}_i + i\alpha\Sigma_j(\vec{k}.\vec{r}_{ij})/r_{ij}^3]\varphi$, where α is a numerical constant $\cong 1/4\pi\rho$ (ρ being the number density of the atoms). The roton state represented by ψ can be described roughly classically as a vortex ring of such small radius that only one atom can pass through the centre. Outside the ring there is a slow drift of atoms returning for another passage through the ring. This return flow is represented by the additional term in the refined wave-function. The ring does not drift forward like a smoke ring and its location is not definable. The minimum roton energy $\Delta/k = 11.7°K$, which should be compared with 19°K of l.c. and with 9.6°K postulated by Landau and others to satisfy specific heat and second sound data. See also Abstr. 5820/1956. H.London

536.48 : 532.612.4

325. SURFACE TENSION OF LIQUID He^4 AND LIQUID He^3. S.K.Trikha and O.P.Rustgi.
Progr. theor. Phys., Vol. 15, No. 3, 296-8 (March, 1956).

An empirical relation between the surface tension and the saturation pressure of liquids (J. phys. Chem., Vol. 46, 1163-7, Dec., 1942) is applied to the helium isotopes. At temperatures higher than 1°K agreement with experiment is good over a relatively wide range of temperatures. Below 1° agreement deteriorates. R.Eisenschitz

536.48

326. NATURE OF THE λ-TRANSITION IN LIQUID HELIUM. S.T.Butler, J.M.Blatt and M.R.Schafroth.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 674-5 (Sept., 1956).

Although it is generally believed that the λ transition is related to the condensation mechanism of an ideal Bose–Einstein gas, the theories proposed so far either give a transition of the third order (continuous specific heat) or else provide no mechanism for a thermodynamic transition. The authors show that the reason for this third-order transition is the neglect of the effects of attractive interaction between the helium atoms. When these effects are taken into account there is no thermodynamic transition but a phenomenon which is called a "quasi-transition". This is a large change in thermodynamic properties in a small temperature interval in the neighbourhood of the "quasi-transition" temperature T_0, such that $\Delta T \ll T_0$. The result for the specific heat has been evaluated with the help of the electronic computer SILLIAC, which predicts that the specific heat drops by more than a factor of two in an interval of 10^{-3} degrees. Reasonable agreement is obtained with experimental results. H.C.Cole

536.48

327. SUPERFLUIDITY OF LIQUID HELIUM. J.M.Blatt, S.T.Butler and M.R.Schafroth.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 676-7 (Sept., 1956).

The theory of the λ-transition reported in the preceding abstract allows a rough estimate of the correlation length in liquid helium, which is consistent with an upper limit of 10^{-2} cm. Thus the superfluid properties of liquid helium are non-equilibrium phenomena which cannot be deduced logically from the present theory. It has however been found possible to calculate the normal fluid concentration from the thermodynamic theory (preceding abstract). Adequate agreement is obtained with the experimental data based on the second sound measurements of Pellam H.C.Cole

536.48

328. THE ABSORPTION OF SOUND IN LIQUID HELIUM BELOW 1°K. J.A.Newell and J.Wilks.
Phil. Mag. (Ser. 8), Vol. 1, No. 6, 588-90 (June, 1956).

The coefficient of absorption is measured at a frequency of 14.4 Mc/s. In presenting the results this coefficient is multiplied by the density, the cube of the velocity of sound and the square of the reciprocal frequency; this quantity is plotted against the temperature (0.4-1.6°K). Results are given for the saturation pressure and for 8.42, 16.4 and 24.7 atm. All graphs are found to have a broad maximum, the position of which varies between 0.8 and 1.1 °K. Results are discussed from the point of view of Khalatnikov's theory. The authors draw attention to experimental difficulties caused by the small damping in helium on account of which the shape of sound pulses can become irregular. R.Eisenschitz

536.48

329. THE COEFFICIENT OF VOLUME ABSORPTION OF SECOND SOUND AND THE VISCOSITY OF THE NORMAL COMPONENT OF HELIUM II DOWN TO 0.83°K. K.N.Zinov'eva.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 31-6 (1956). In Russian.

Measurements on the absorption of second sound have been extended down to 0.83°K at a frequency from 200 c/s to 4 kc/s by the method of determination of the width of the resonance curves for standing waves. The coefficients of volume absorption α/ω^2 and viscosity coefficient η of the normal component of the He II have been obtained by separating the volume and surface losses. It has been established that losses due to heat conduction are dominant in volume absorption. The analogue of the heat transfer coefficient has been computed for He II. The results completely confirm the Landau–Khalatnikov theory of He II kinetic coefficients. A.

536.521

330. A PHOTOELECTRIC SPECTROPYROMETER OF HIGH ACCURACY. V.V.Kandyba and V.A.Kovalevskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 633-5 (1956). In Russian.

An experimental apparatus for comparing the intensities of two light sources is described. The beams are focused simultaneously on an oscillating prism (860 c/s), thence through a monochromator to a photomultiplier. The photocurrent is amplified and a phase sensitive detector indicates when the

sources are equal. It is claimed that this apparatus is considerably more accurate than existing methods of high temperature estimation. Some applications are suggested.

J.B.Arthur

536.587

331. APPARATUS FOR OBTAINING HEATING AND COOLING CURVES. L.A.Burkardt, W.S.McEwan and H.W.Pitman.
Rev. sci. Instrum., Vol. 27, No. 9, 693-6 (Sept., 1956).

The apparatus described permits the study of phase diagrams either by heating or cooling. One temperature control circuit permits a preset temperature gradient, either positive or negative, to be maintained between the sample and bath with the temperature of the bath being controlled by that of the sample. The appearance or disappearance of solids in the sample is followed by measurement of the light transmission of the sample. A second control circuit provides constant bath temperatures. A step-wise approach to the liquidus point, with the light transmission used to indicate the establishment of equilibrium between solid and liquid at each step, offers a means of determining this point under equilibrium conditions.

A.

536.587 : 621.316.7

332. ANALYSIS OF PHASE-SHIFT CONTROLLED THERMOREGULATOR CIRCUITS. A.A.Brooks.
Rev. sci. Instrum., Vol. 27, No. 9, 746-8 (Sept., 1956).

The power sensitivity and the line-voltage variation effects of a phase-shifting thermoregulator making use of a thermal element in a Wheatstone bridge and a grid-controlled thyratron are expressed in terms of the circuit parameters. The conditions for line-voltage variation compensation are derived and the calculated results are found to be in good agreement with the experimental value.

A.

536.621

333. ADIABATIC SOLUTION CALORIMETER.
G.C.Benson, E.D.Goddard and C.A.J.Hoeve.
Rev. sci. Instrum., Vol. 27, No. 9, 725-7 (Sept., 1956).

The solution calorimeter described in Abstr. 6093 (1955) has been modified by using an electrically heated shield for the adiabatic control. In this way the response time has been decreased by a factor of ten which greatly facilitates operation of the control. Under steady conditions the fluctuation in temperature between the calorimeter and its surroundings has been reduced from $\pm$ 0.002 to $\pm$ 0.001 deg. C max. The calorimeter has a working range of 10° to 50° C.

A.

536.627 : 536.631

334. A HIGH TEMPERATURE ADIABATIC CALORIMETER AND THE SPECIFIC HEAT OF URANIUM BETWEEN 100° AND 800° C. J.M.North.
Atomic Energy Res. Establ. (Harwell) Rep. No. M/R 1016, 9 pp. (1956).

The apparatus described enables the measurement of the specific heat of solid materials to be made in vacuo in the temperature range 100° to 800° C. The specimen is heated electrically, and is supported in an enclosure which is kept at the same temperature by a servo-mechanism. Under these conditions the specimen neither loses nor gains heat from its surroundings, and by measurement of the energy input to the specimen and its rate of temperature increase, the specific heat may be calculated. The reproducibility of the method is ±2%. The specific heat of uranium has been measured between 100° and 800° C and the latent heats of transformation of the $\alpha\beta$ and $\beta\gamma$ change points determined. Modifications for improving the accuracy of the method are suggested.

A.

536.631

335. SPECIFIC HEAT OF SOLID OXYGEN BETWEEN 20 AND 4° K. M.O.Kostryukova.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1162-4 (1956). In Russian.

This experimental investigation was made in order to check the results of previous measurements, to extend available data to temperatures below 10° K and, in particular, to test the possibility of an antiferromagnetic transition. A large number of measurements result in a smooth specific heat–temperature curve which is compatible with all measurements published so far. At low temperatures results are well in agreement with a T^3-law. There is no indication of either a term proportional to the first power or of any anomaly. The possibility of a transition seems accordingly to be ruled out.

R.Eisenschitz

ELECTRICITY 537

537.12 : 530.162

336. ON THE BOHM–PINES THEORY OF A QUANTUM-MECHANICAL ELECTRON PLASMA. C.G.Kuper.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 492-5 (June, 1956).

The cut-off wave vector k_c, used by Bohm and Pines to take account of the fact that collective motion in an electron plasma does not occur for short wavelengths, is replaced by a function $\gamma(k)$. The derivation of a screened interaction is still possible and the Bohm–Pines theory is obtained if $\gamma(k) = 1$ for $k < k_c$ and 0 for $k > k_c$. It is shown that unreasonable choices for $\gamma(k)$ lead to absurd results within the framework of the theory, since they lower the expectation value of the energy. This is due to the neglect of certain subsidiary conditions for the wavefunction, and therefore the argument of Bohm and Pines which leads to a screened interaction between particles in the plasma does not seem to be satisfactory.

P.T.Landsberg

ELECTROSTATICS. DIELECTRICS 537.2

537.221

337. MECHANISM OF FRICTIONAL ELECTRIFICATION OF DIELECTRIC LIQUIDS. F.M.Ernsberger.
J. appl. Phys., Vol. 27, No. 4, 419-19 (April, 1956).

A new theory is proposed, based on the results of some experiments on the electrification of hydrocarbon fuels. It is suggested that a layer of chemically-adsorbed, electrically-neutral molecules exists at the interface between solid and liquid. The adsorption is assumed to be so weak that thermal activation at ordinary temperatures is adequate for maintaining dynamic equilibrium between adsorption and desorption. To account for charge separation it is proposed that some of the desorptions are anomalous, in that a molecule may desorb with either an excess or deficit of electrons. About one in 10^{12} desorptions need be anomalous to account for the current densities which are normally observed.

A.E.Kay

537.224

338. ON THE CALCULATION OF THE MUTUAL CAPACITANCE OF SOLIDS OF SMALL DIMENSIONS. A.Ya.Breĭtbart and I.L.Lyudmirskiĭ.
Zh. tekh. Fiz., Vol. 26, No. 5, 1094-105 (1956). In Russian.

Develops very simple formulae for the mutual capacitance of two isolated bodies in terms of their self-capacitances C_1 and C_2 and the distance apart R (mutual capacitance = C_1C_2/R) and extends this to the case of bodies in the neighbourhood of a conducting plane and to more than two bodies. Shows that results are in reasonable agreement with experiment.

J.M.Hough

537.226

339. DIELECTRIC PROPERTIES OF A LATTICE OF ANISOTROPIC PARTICLES. S.B.Cohn.
J. appl. Phys.. Vol. 27, No. 9, 1106-7 (Sept., 1956).

A graph is presented comparing a number of theoretical and experimental results on the dielectric properties of a tetragonal array of circular metallic disks.

J.S.Bell

537.226.1

340. DEPENDENCE OF THE REFRACTIVE INDEX ON DENSITY FOR LOW AUDIO FREQUENCIES. G.P.Motulevich and I.L.Fabelinskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 4, 637-40 (1956). In Russian.

Results of static and dynamic (frequency 10^7 c/s) methods of determining the value $\rho\frac{\partial\epsilon}{\partial\rho}$ (cf. Abstr. 5425/1953), where ρ = density and ϵ = dielectric constant, differ by a magnitude exceeding the experimental errors of the two methods. Dynamic measurements with 50 c/s were carried out by the authors, the density of the liquid being varied at this frequency by means of the membrane of an electromagnetic emitter. It was found that the values of $\rho\frac{\partial\epsilon}{\partial\rho}$ at 50 c/s coincided with those obtained by the static method.

F.Lachman

PA

537.226.2

341. NEW FERROELECTRICS AND ANTIFERROELECTRICS OF OXYGEN-OCTAHEDRAL TYPE. G.A.Smolenskiĭ.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 20, No. 2, 163-77 (1956). In Russian.

New ferroelectrics and antiferroelectrics discovered in recent years are of perovskite, ilmenite and rhenium trioxide types. Experiments showed that spontaneous polarization may occur in crystals the octahedra of which are partly populated with cations of the electronic structure of a rare gas atom after removal of s- and d-electrons, with high charge and small ionic radius. An exception is crystals containing Pb^{++} ions, owing to the effect of these ions on the bonds in the crystals. Electrical Research Association

537.226.2

342. FERROELECTRICITY IN THE LANGBEINITE SYSTEM. F.Jona and R.Pepinsky.
Phys. Rev., Vol. 103, No. 4, 1126 (Aug. 15, 1956).

Crystals of $(NH_4)_2Cd_2(SO_4)_3$, with the cubic langbeinite $(K_2Mg_2(SO_4)_3)$ structure at room temperature, show an optically detectable change to a ferroelectric state at about 87°K. For fields along the cubic [111] directions the dielectric constant is 9.5 at room temperature, and reaches a low peak ($\epsilon_{111} = 10.2$) at 89°K. At 83°K the spontaneous polarization is 0.3 μ coulomb/cm^2 and the coercive field approximately 15 kV/cm. L.E.Cross

537.226.2

343. THERMAL INDEPENDENCE OF PERMITTIVITY OF FERROELECTRIC HETEROGENEOUS SYSTEMS. Z.Pająk and A.Piekara.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 4, No. 2, 83-7 (1956).

Two ceramic powders were prepared consisting of different Ba/Sr titanate solid solutions, their peak permittivities occurring at 0° and 70°C. On mixing equal parts of the two powders and sintering at 1200°C, only limited diffusion between the grains occurred and a permittivity of 1800, varying by less than 10% between 10° and 70°C, resulted. Further heat treatment tended to produce a single permittivity peak corresponding to the mean composition of the ceramic. K.W.Plessner

537.226.2

344. OBTAINING MONOCRYSTALS OF SOLID SOLUTIONS OF BARIUM AND STRONTIUM TITANATES AND THEIR DIELECTRIC AND OPTICAL PROPERTIES. A.L.Khodakov, M.L.Sholokhovich, E.G.Fesenko and O.P.Kramarov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 825-8 (1956). In Russian.

The crystals were obtained by evaporating solutions of mixtures of barium and strontium titanates in potassium fluoride and successive slow cooling. Crystals with various proportion of Ba and Sr were obtained and tested, before and after a heat treatment, at various temperatures, voltages and frequencies. The measured values of permittivity, angle of dielectric losses, refractive index, etc. are given. A.Karlsbad

537.226.2

345. ON A CHANGE OF DIELECTRIC PROPERTY OF $(Ba_{0.5}Sr_{0.5})TiO_3$ CERAMICS DUE TO THE THERMAL TREATMENT. S.Nomura.
J. Phys. Soc. Japan, Vol. 11, No. 7, 803-4 (July, 1956).

The Curie temperature of ceramic $(Ba_{0.5}Sr_{0.5})TiO_3$, determined from the peak in $\epsilon \propto T$, is lowered when the samples are pre-treated thermally by rapid cooling in air at room temperature from temperatures above 1100°C. Similar changes are not observed in pure ceramic $BaTiO_3$, and the effect is attributed to increased disorder in the arrangement of Ba^{2+} and Sr^{2+} ions on the lattice of the mixed crystals. L.E.Cross

537.226.31

346. ON THE DIELECTRIC LOSSES AND THE ELECTRICAL CONDUCTIVITY OF CERAMIC BARIUM TITANATE FOLLOWING A QUENCH THROUGH THE PHASE CHANGE AT 120°C. J.Meisinger.
Z. angew. Phys., Vol. 8, No. 9, 422-4 (Sept., 1956). In German.

Specimens of pure $BaTiO_3$ and of mixtures containing about 1 mole % Cr_2O_3 or WO_3, after air-quenching from 500°C, show an increased loss tangent (at 1 kc/s) and d.c. conductivity. A roughly exponential decay takes place and after one or two days normal values are regained, $\tan\delta$ approaching 4×10^{-3} and the conductivity $2 \times 10^{-10}\ \Omega^{-1}\ cm^{-1}$. The phenomenon is interpreted in terms of lattice defects introduced during the rapid change of crystal structure at 120°C, the defects being gradually eliminated during subsequent storage. K.W.Plessner

537.226.33

347. ON THE AVERAGE DIELECTRIC RELAXATION TIME OBTAINED BY MEANS OF COLE PLOTS. S.Zaromb.
J. chem. Phys., Vol. 24, No. 5, 1110 (May, 1956).

The average relaxation time (τ_0) obtained from a Cole plot is given by $\Sigma_i x_i(\tau_0^2 - \tau_i^2)/(\tau_0^2 + \tau_i^2) = 0$ where x_i is the fraction of molecules with relaxation time τ_i. The decrease observed in τ_0 on the introduction of 0.002% NH_4F into ice is analysed in terms of this equation, and indicates that the addition of NH_4F can increase the rate of rotation of the molecules separated by a distance of 30 A from any ion. G.Allen

537.226.8

348. THE EFFECT OF DIPOLES ON ELECTRIC STRENGTH. H.Pelzer.
Rep. Brit. Elect. Res. Assoc., Rep. L/T320, 7 pp. (1954).

It is shown that experimental findings about intrinsic electric strength of high polymers could be explained by the influence of dipolar groups on electron scattering if the dipoles may be assumed to scatter independently. This assumption appears plausible even for substances which show crystallinity. Experimental evidence seems to indicate that the influence of order (crystalline or amorphous state) in the dielectric on intrinsic electric strength is not so important as had been believed. On the other hand, the increase of the low-temperature electric strength in the presence of dipoles appears to be or overriding importance. A.

537.228 : 535.417

349. NEW METHOD OF MEASURING DIRECTLY THE PIEZO-OPTIC EFFECT; APPLICATION TO QUARTZ. I. B.Vittoz.
Rev. Opt., Vol. 35, No. 5, 253-91 (May, 1956). In French.

The first part of this paper deals with the theoretical derivation of the piezo-optic constants of quartz by extending the method of Pockels and Mason. The second part describes a three-beam interferometer for making direct measurements of the piezo-optic effect and considers the theory of the instrument in detail. H.J.H.Starks

537.228.1 : 621.372.412 : 621.317.337

350. VARIATION OF Q-FACTOR OF PIEZOELECTRIC CRYSTALS AS A FUNCTION OF PRESSURE. H.Mayer.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 246-9 (July 16, 1956). In French.

Curves are given of the Q-factor for quartz and Rochelle salt at pressures in the range 10^{-3} mm Hg to 12 atm. The Q remains sensibly constant at pressures below 10^{-2} mm but above that pressure it falls progressively to about one-half for quartz and to nearly one-third for Rochelle salt at a pressure of 12 atm. H.J.H.Starks

537.228.1 : 621.315.612

351. EFFECT OF PRESSURE ON THE DIELECTRIC CHARACTERISTICS OF FERROELECTRIC CERAMICS. I.A.Izhak.
Izv. Akad. Nauk SSSR, Ser. fiz., Vol. 20, No. 2, 199-205 (1956). In Russian.

The piezoelectric properties of ferroelectric ceramics are very complex, since they are influenced not only by the pressure exerted, but also by the field applied, its frequency, and by the constitution of the ceramics and the temperature. One fact emerging clearly is that for every type of ceramic there is a field strength at which the material is most sensitive to pressure, and certain admixtures increase, others reduce this sensitivity. Electrical Research Association

ELECTRIC CONDUCTION. CURRENTS 537.3

537.311.1

352. SIMPLIFIED THEORY OF SPACE-CHARGE-LIMITED CURRENTS IN AN INSULATOR WITH TRAPS. M.A.Lampert.
Phys. Rev., Vol. 103, No. 6, 1648-56 (Sept. 15, 1956).

An ohmic contact between a metal and an insulator facili-

tates the injection of electrons into the insulator. Subsequent flow of the electrons is space-charge-limited. In real insulators the trapping of electrons in localized states in the forbidden gap profoundly influences the current flow. The interesting features of the current density–voltage (J–V) characteristic are confined within a "triangle" in the logJ–logV plane bounded by three limiting curves: Ohm's law, Child's law for solids ($J \propto V^2$) and a traps-filled-limit curve which has a voltage threshold and an enormously steep current rise. Simple inequalities relating the true field at the anode to the ohmic field facilitate qualitative discussion of the J–V characteristic. Exact solutions have been obtained for an insulator with a single, discrete trap level in a simplified theory which idealizes the ohmic contact and neglects the diffusive contribution to the current. The discrete trap level produces the same type of nonlinearity discovered by Smith and Rose and attributed by them to traps distributed in energy. A.

537.31 : 535.345 : 539.217

X-RAY ABSORPTION IN Co-Cr ALLOYS. See Abstr. 776

537.311.1

353. A REMARK ON THE INFLUENCE OF HIGH FREQUENCY ELECTRIC FIELDS AND UNIFORM MAGNETIC FIELDS ON ELECTRONIC CONDUCTION. R.B.Dingle.
Physica, Vol. 22, No. 8, 701-2 (Aug., 1956).

It is shown that the simultaneous effects of high-frequency electric fields and of a uniform magnetic field can be expressed in terms of types of functions of the relaxation time which are of the same form as the functions which occur when either influence alone is present. P.T.Landsberg

537.311.1

354. A GENERAL QUASI-CLASSICAL THEORY OF DIAMAGNETIC ("CYCLOTRON") RESONANCE IN ELECTRONIC CONDUCTORS. R.B.Dingle.
Physica, Vol. 22, No. 8, 703-4 (Aug., 1956).

The expression for a complex current density derived in the preceding abstract is applied to a discussion of cyclotron resonance. P.T.Landsberg

537.311.1

355. A NOTE ON THE ELECTRON DISTRIBUTION FUNCTION IN INSULATORS AT HIGH FIELD STRENGTH. J.J.O'Dwyer.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 685-6 (June, 1956).

Indicates how an omission in Franz's treatment (Abstr. 8860/1952) of this problem can be rectified, the result then becoming identical with Fröhlich's solution (Abstr. 339/1947). K.W.Plessner

537.311.1

356. ON THE ENERGY DISSIPATION OF CONDUCTION ELECTRONS UNDERGOING ELASTIC SCATTERING BY IMPURITIES. T.Yamamoto, K.Tani and K.Okada.
Progr. theor. Phys., Vol. 15, No. 2, 184-5 (Feb., 1956).

A mechanism is suggested to account for the dissipation of energy which conduction electrons lose by elastic scattering from impurities (at low temperatures) and which under the conditions of steady current flow, balances the energy supplied by the battery. C.A.Hogarth

537.311.1 : 548.7

357. A NEW QUANTUM MECHANICAL PRINCIPLE OF CONDUCTIVITY AND A CRITIQUE OF BLOCH'S THEORY. H. Stumpf.
Z. Naturforsch., Vol. 11a, No. 4, 259-65 (April, 1956). In German.

Using the adiabatic approximation for the Schrödinger equation for a whole crystal, two distinct types of interactions between the electron system and the lattice are discussed: for the first type conservation theorems for the subsystems (electron and lattice) are permissible, while for the second they are not. Conductivity is the result of interaction between electron system and lattice. This is characterized by the principles: (1) only interactions of the second type are to be used for the irreversible exchanges of impulse and energy; (2) the subsystems must be able to persist in isolation. These requirements single out almost unambiguously the wave-functions of the adiabatic approximation as the basis for a theory of conductivity. Bloch's theory of conductivity is critically examined from this point of view, which is also indicative of a theoretical formulation of superconductivity. F.Ansbacher

537.311.1 : 537.532.2

358. NOTE ON PAPERS BY S.É.KHAĬKIN, S.V. LEBEDEV, L.N.BORODOVSKAYA PUBLISHED IN ZH. ÉKSPER. TEOR. FIZ. IN 1954-55. I.F.Kvartskhava.
Zh. éksper. teor. Fiz., Vol. 30, No. 3, 621-3 (1956). In Russian.

Khaĭkin et al. came to the following conclusions in the case of large short pulses passing through metallic wires: (a) for a pulse density of the order of 10^6-10^7 A/cm^2, "an abnormal nonmetallic state of the material is produced" and hence "a sharp change of resistance of the wire depending on the energy involved"; (b) in tungsten and steel wire in a vacuum "abnormal electron emission" occurs "not obeying the Bogoslovski-Langmuir law". For (a) it is pointed out that Kvartskhava et al. (Abstr. 7017/1955, 5130/1956), showed that Ohm's law is maintained up to a density of 10^7 A/cm^2. For (b) Khaĭkin et al. did not take into consideration the discharges in gases and secondary shunting currents. Two phenomena may occur: (i) during the pulse the occluded gases and particles of metal may evaporate from the surface of the wire and produce pressure around it, then shunting discharges may occur; (ii) increased electron emission may be explained if a large emitting surface and a reduced magnetic field are assumed. These conditions are fulfilled if heavy current discharges appear shunting the wire. M.W.Makowski

537.311.1 : 538.63

359. QUANTUM THEORY OF ELECTRICAL CONDUCTIVITY OF METALS IN A MAGNETIC FIELD. I.M.Lifshits.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 814-16 (1956). In Russian.

In previous work (Abstr. 6658/1956 and Zh. éksper. teor. Fiz., Vol. 9, 1169, 1939) on galvanomagnetic effects in strong fields the electron was considered to behave in a classical manner with a dispersion law $\epsilon = \epsilon(p)$. Such a treatment neglects specific effects connected with the quantization of energy levels (e.g. periodic change of resistance for a change in the magnetic field) observed experimentally (Abstr. 4999/1950). A quantum equation for the current is derived. The method may also be used to explain the periodic variation of susceptibility with magnetic field (de Hass–van Alphen effect). W.Bardsley

537.311.1 : 538.63

360. ON THE THEORY OF GALVANOMAGNETIC PHENOMENA IN METALS. I.M.Lifshits, M.Ya.Azbel' and M.I.Kaganov.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 63-79 (1956). In Russian.

A theory of galvanomagnetic phenomena in metals in strong magnetic fields is proposed; no special assumptions regarding the law dispersion of conduction electrons or the form of the collision integral are made. A.

537.311.31 : 539.234

361. ON THE RESISTIVITY OF VERY THIN METALLIC FILMS. G.Darmois.
C.R. Acad. Sci (Paris), Vol. 243, No. 3, 241-3 (July 16, 1956). In French.

The author's theory of the temperature coefficient of resistance of thin films (see Abstr. 6611/1956) is shown to be supported by experimental work by Mostovetch (Abstr. 4797/1953). A value of 3×10^{13} sec^{-1} is found for the ratio of thermal velocity to mean free path for electrons in very thin films of Cu and W. It is also shown that the two-dimensional theory gives qualitative agreement with observed results on the variation of resistance with thickness. D.G.Avery

537.311.31

362. ON THE QUESTION OF NOISE IN METALLIC CONDUCTORS. H.Bittel and K.Scheidhauer.
Z. angew. Phys., Vol. 8, No. 9, 417-22 (Sept., 1956). In German.

A search of the literature suggested that a noise component, both current- and frequency-dependent, as found in semiconductors, might arise when current passes through metallic conductors. Experiments in the range 45 c/s to 11.5 kc/s failed to detect any such component. C.A.Hogarth

537.311.32 : 538.632

363. ON THE HALL COEFFICIENT OF POLYCRYSTALLINE GRAPHITE. O.Hauser.
Z. phys. Chem. (Leipzig), Vol. 205, No. 4, 241-3 (March, 1956). In German.

The Hall coefficient of polycrystalline graphite is very

dependent on the temperature of previous heat treatment, being small and negative for pre-heating below 1500°C, rising to a maximum positive value at 2000°C, and falling to zero at 2350°C and to negative values again at temperatures up to 2800°C. The results are discussed in terms of the defects in the material frozen-in by cooling from high temperatures, and in terms of the crystal structure as determined by X-ray diffraction. C.A.Hogarth

537.311.33

364. CHARACTERISTIC TIMES OF ELECTRON PROCESSES IN SEMICONDUCTORS. É.I.Adirovich and G.M.Guro.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 417-20 (1956). In Russian.

From energy band equations, four characteristic times are derived, two of which are identical with the Shockley—Read hole and electron lifetimes. At large trap densities the other two become important, coinciding with the Shockley—Read values only when the trap level is below the Fermi level. Two methods of lifetime measurement are examined and doubts cast on their validity. J.B.Arthur

537.311.33 : 621.314.7

365. ON THE THEORY OF TRANSPORT PROCESSES IN SEMICONDUCTING TRIODES. É.I.Adirovich and V.G.Kolotilova.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 629-32 (1956). In Russian.

Calculations show that the carrier transport mechanism in a p—n—p structure with grounded emitter or collector is essentially different from that with grounded base. The response of such an arrangement to a δ-function input pulse is worked out and it is shown that the decay time of the output signal is τ, the minority carrier lifetime in the base region, whereas, in the earthed-base configuration the decay time is a function of the base thickness and the minority carrier diffusion length. It is proposed that this fact accounts for the higher upper frequency limit observed in a grounded-base transistor.

J.B.Arthur

537.311.33

366. VISUAL EVIDENCE OF INVERSION LAYERS ON SEMICONDUCTOR MATERIALS. P.Levesque.
J. appl. Phys., Vol. 27, No. 9, 1104-5 (Sept., 1956).

The inversion layer over a p-n junction has been studied. The region of maximum electric field was revealed by treating the junction with a suspension of $BaTiO_3$. The effect of bias voltages on the displacement of the region of maximum field was also studied. W.Bardsley

537.311.33 : 538.63

367. D.C. MAGNETOCONDUCTIVITY AND ENERGY BAND STRUCTURE IN SEMICONDUCTORS. R.M.Broudy and J.D.Venables.
Phys. Rev., Vol. 103, No. 4, 1129-30 (Aug. 15, 1956).

Theories of the behaviour of semiconductors in electric and magnetic fields give directly the magnetoconductivity tensor L while usual measurements give the magnetoresistivity tensor $P = L^{-1}$. An experimental technique has been devised to evaluate L directly. This consists in rotating H in one particular plane of crystal symmetry, but in different sample planes in several experiments. Application to n-type germanium and silicon at 80°K reproduces the known energy-band structure. W.Bardsley

537.311.33 :621.314.7

368. PROPAGATION OF A SHORT PULSE IN A SEMICONDUCTOR BOUNDED BY TWO HOLE-ELECTRON TRANSITIONS. É.I.Adirovich and V.G.Kolotilova.
Zh. éksper. teor.Fiz., No. 6(12), 770-7 (1955). In Russian.
English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 670-6 (July, 1956).

A calculation of the propagation of a short pulse in a semiconductor bounded by two hole-electron transitions, one of which (x = 0) has a positive and the other (x = w) a negative bias such that a semiconducting triode system exists. The form of the impulse is approximated by a δ-function. With the aid of Laplace transforms the current in p-presentation at any semiconductor section was obtained. Transforming to the original representation at x = w permits one to obtain the expression for the collector current i(w, t) and clarifies the influence of diffusion and recombination of the nonequilibrium current carriers in a semiconductor on the form of the impulse at the collector. A.

537.311.33

369. ON THE QUESTION OF SURFACE RECOMBINATION. V.L.Bonch-Bruevich.
Zh. tekh. Fiz., Vol. 26, No. 6, 1137-40 (1956). In Russian.

The theory of recombination in a thin surface layer is compared with that of a non-uniform distribution of recombination centres throughout the specimen. If the recombination velocity s is taken to be zero, both theories give qualitatively the same result. If $s \neq 0$ and the lifetime varies throughout the specimen, the effects of pure surface recombination and non-uniform distribution tend to mask each other, leading to an erroneous result in the experimental determination of s. J.B.Arthur

537.311.33

370. THE INFLUENCE OF IMPURITIES ON THE PROPERTIES OF ALUMINIUM ANTIMONIDE. K.Šmirous.
Czech. J. Phys., Vol. 6, No. 3, 299-300 (June, 1956). In Russian.

6.7 ohm.cm p-type AlSb was prepared by zone melting, and n-type material of 350 ohm.cm obtained from this by adding Te. Additions of between 1 and 5 x 10^{19} atoms/cm^3 of Cu, Ag, Au, Zn, Cd, Se and Te to both n- and p-type AlSb were also studied. Precautions were taken during doping to suppress loss of Sb by volatilization. Zn, Cd acted as acceptors, Se, Te as donors. Cu, Ag, Au show no definite action but lowered resistivity. C.H.L.Goodman

537.311.33

371. ELECTRICAL PROPERTIES OF Bi_2Te_3. S.Shigetomi and S.Mori.
J. Phys. Soc. Japan., Vol. 11, No. 9, 915-19 (Sept., 1956).

The conductivity, the Hall coefficient and the thermoelectric power of the compound Bi_2Te_3 have been measured over the temperature range from 100°K to 750°K. The specimens used show electrical conduction of p-type at room temperature and the hole mobility temperature dependence is represented by the relation $\mu_h = 1.2 \times 10^8 T^{-2.3}$. It is found that the forbidden energy gap E_G is 0.21 eV at 0°K, and the effective masses of holes and electrons are, respectively, 1.26 m and 1.07 m, and the mobility ratio b is about 1.7. A.

537.311.33

372. ELECTRICAL PROPERTIES OF THE CHALCOGENIDES OF BISMUTH. I. ELECTRICAL PROPERTIES OF BISMUTH SULPHIDE Bi_2S_3. P.P.Konorov.
Zh. tekh. Fiz., Vol. 26, No. 5, 1126-8 (1956). In Russian.

Bi_2S_3 specimens were prepared by sintering under pressure. For stoichiometric material the electrical conductivity was $\sim 10^{-3}$ohm^{-1}cm^{-1} with thermal activation energies of ~ 0.17 eV up to 400°K and ~ 1 eV above. Thermoelectric power was ~ 1300 μV/deg C, n-type, at room temperature, and from its variation with temperature the intrinsic activation energy of 1 eV was confirmed. No specimen gave a measurable Hall effect. C.H.L.Goodman

537.311.33

373. NATURE OF EDGE EMISSION IN CADMIUM SULFIDE. J.J.Lambe, C.C.Klick and D.L.Dexter.
Phys. Rev., Vol. 103, No. 6, 1715-20 (Sept. 15, 1956).

Experimental and theoretical evidence is reviewed to determine if edge emission in CdS is due to exciton recombination or is characteristic of a centre. New evidence is presented which shows that edge luminescence may be produced in CdS at low temperatures by stimulating with infrared light, and simultaneous measurements have been made on the decay of edge luminescence and conductivity in single crystals at 4°K under this irradiation. It is concluded that emission occurs by recombination of a free hole with an electron shallowly trapped at an imperfection. The atomic nature of the imperfection is examined briefly. A.

537.311.33 : 548.5

374. DEFECTS IN GERMANIUM CRYSTALS GROWN FROM THE MELT. E.Billig.
Brit. J. appl. Phys., Vol. 7, No. 10, 375-6 (Oct., 1956).

Thermal stresses arising from differential shrinkage as the crystal cools down from the freezing point to room temperature are considered as a major source of structural defects. The distribution of etch pits over various parts of a crystal has been studied and correlation has been obtained with the lifetime of minority carriers and with transistor action. A.

537.311.33

375. DISTRIBUTION COEFFICIENT OF BORON IN GERMANIUM. H.E.Bridgers and E.D.Kolb.
J. chem. Phys., Vol. 25, No. 4, 648-50 (Oct., 1956).

The effective distribution coefficient of boron in germanium has been measured as a function of crystal growth rate. Its behaviour is shown to agree with that predicted by the theory of Burton et al. for a solute whose equilibrium distribution coefficient is greater than unity. The coefficient decreases rapidly with increasing growth rate from its equilibrium value 17.4 to 2.2 at a growth rate of 10^{-2} cm/sec. A.

537.311.33

376 THEORY OF THE IONIZATION OF HYDROGEN AND LITHIUM IN SILICON AND GERMANIUM. H.Reiss.
J. chem. Phys., Vol. 25, No. 4, 681-6 (Oct., 1956).

Contains an effective-mass quantum-mechanical investigation of the ionizability of interstitial hydrogen and lithium in germanium and silicon. It is concluded that hydrogen should not ionize while lithium should. This seems in accord with experimental findings. A.

537.311.33 : 538.63

377. GALVANOMAGNETIC EFFECTS OF A HEAVILY DOPED GERMANIUM CRYSTAL. W.Sasaki and Y.Kanai.
J. Phys. Soc. Japan, Vol. 11, No. 8, 894-5 (Aug., 1956).

Reports measurements between 1.3°K and 280°K of electrical resistivity ρ, Hall constant R, and Hall mobility $\mu_R = R/\rho$. At room and liquid air temperatures $\Delta\rho/\rho$ increases with increased magnetic field H, while at liquid helium temperatures there is a minimum in the curve at 1.5×10^4 gauss after an initial decrease. This magnetoconductive effect is more temperature sensitive than the variation of ρ or R in the liquid helium range. W.Bardsley

537.311.33

378. SOME EXPERIMENTS ON THE GERMANIUM SURFACE LAYER. M.Kikuchi.
J. Phys. Soc. Japan, Vol. 11, No. 8, 898 (Aug., 1956).

The Valdes four-probe method has been applied to an n-type Ge single crystal on which a thin p-type layer was formed by heating. The variation of potential across the two inner probes as a function of ambient (vacuum, air, wet air and O_3) is recorded. W.Bardsley

537.311.33

379. THE FIELD-DEPENDENCE OF ELECTRON MOBILITY IN GERMANIUM. J.B.Gunn.
J. Electronics, Vol. 2, No. 1, 87-94 (July, 1956).

The drift velocity of conduction electrons in germanium has been measured as a function of electric field E. Even at fields as low as 100 V cm^{-1}, the velocity increases slightly less than proportionately, and this deviation increases smoothly until, between 4.5 and 9×10^3 V cm^{-1}, it becomes independent of E. Above the latter value, the velocity increases nearly as $E^{0.134}$, and at 6.3×10^4 V cm^{-1} avalanche multiplication is observed. No region in which the velocity is proportional to $E^{1/2}$ has been observed. A.

537.311.33

380. TRAP ACTIVATION ENERGIES IN N-TYPE GERMANIUM. P.Ransom and F.W.G.Rose.
J. Electronics, Vol. 1, No. 6, 625-8 (May, 1956).

Lifetime measurements were made on Sb-doped single-crystal Ge with resistivities from 12.0 to 50 Ω cm in the temperature range 240-295°K using the Morton-Haynes method. From such measurements in darkness and with various intensities of background illumination it seems possible to determine both the activation energy and the concentration of different traps in a single sample. W.Bardsley

537.311.33

381. ACCEPTORS QUENCHED INTO GERMANIUM. S.Mayburg.
Phys. Rev., Vol. 103, No. 4, 1130-1 (Aug. 15, 1956).

Recently Logan (Abstr. 2872/1956) and Hopkins and Clarke (Abstr. 2099/1956) presented evidence which seems to be contradictory to earlier experiments by Mayburg (Abstr. 8283/1954) and which appears to be mutually contradictory. It is observed that the differences can be rationalized by noting the effects of dislocations on the annealing process. W.Bardsley

537.311.33 : 537.226.2

382. EFFECT OF NEUTRAL IMPURITY ON THE MICROWAVE CONDUCTIVITY AND DIELECTRIC CONSTANT OF GERMANIUM AT LOW TEMPERATURES. F.A.D'Altroy and H.Y.Fan.
Phys. Rev., Vol. 103, No. 6, 1671-4 (Sept. 15, 1956).

Conductivity and dielectric constant of germanium at 4.2°K were measured at a frequency of 9200 Mc/s. The dielectric constant measured for a pure sample is 16.0 ± 0.3. Higher dielectric constants, up to 80, were measured on n- and p-type samples doped with antimony or gallium. The conductivity and the change of dielectric constant are attributed to carriers in the impurity states. A positive contribution, ΔK_b, to the dielectric constant is given by the polarization of neutral impurity atoms and a negative contribution, ΔK_c, is associated with the conduction effect. Using ΔK_b to estimate the ionization energy of the impurity, a value of 0.0099 eV is obtained for a sample containing 1.6×10^{16} cm^{-3} antimony and 0.0084 eV is obtained for a sample containing 3.7×10^{16} cm^{-3} gallium. Samples of higher impurity concentrations showed much higher conductivity and the effect of overlapping of impurity states is shown in the variation of impurity polarizability. The relaxation time and effective mass for the conduction in impurity states are estimated from the d.c. conductivity and its ratio to the microwave conductivity. Large effective masses, around 1000 m, are obtained for samples of $\sim 10^{17}$ cm^{-3} impurity concentration. A.

537.311.33

383. EQUILIBRIUM DISTRIBUTION OF EXCESS CHARGE CARRIERS IN GERMANIUM UNDER PARTIAL ILLUMINATION. S.V.Bogdanov.
Zh. tekh. Fiz., Vol. 26, No. 5, 917-26 (1956). In Russian.

The distribution of excess carriers in a specimen, part of which is illuminated, is shown to be exponential in both the illuminated and dark parts. From the exponent the minority carrier diffusion length can be calculated for any resistivity (including intrinsic). The magnitude and distribution of the space charge are calculated. The internal field due to the space charge has a maximum at the boundary of the illuminated region, decreasing symmetrically with distance on both sides. A p.d. is set up whose magnitude depends on light intensity, diffusion length and resistivity of the material. J.B.Arthur

537.311.33

384. NUCLEAR MAGNETIC RESONANCE OF Si^{29} IN N- AND P-TYPE SILICON. R.G.Shulman and B.J.Wyluda.
Phys. Rev., Vol. 103, No. 4, 1127-9 (Aug. 15, 1956).

This has been observed in high purity silicon at room temperature and the spin–lattice relaxation time determined as a function of sample resitivity. Because of the long relaxation times, which range over 0.2 to 400 min, it was necessary to use adiabatic fast-passage detection (Abstr. 407/1947). Further results and detailed discussion are to be published. W.Bardsley

537.311.33 : 621.314.7

385. TRANSISTORS. VOLUME I.
Princeton, N.J.: R.C.A. Laboratories (1956) 676 pp.

A selection of papers describing research and development work of the Radio Corporation of America as it applies to the theory, fabrication, and application of transistors. Abstracts of some of the papers will be published later.

537.311.33 : 537.312.5

386. P–N JUNCTIONS IN PHOTOSENSITIVE PbS LAYERS. J.Bloem.
Appl. sci. Res. B, Vol. 6, No. 1-2, 92-100 (1956).

It has been possible to produce PbS layers containing sharp p–n junctions by partly coating a glass substrate with a trivalent metal and then precipitating a PbS layer from an aqueous solution. A photo-e.m.f. up to 300 mV was observed, corresponding to the value of the energy gap of about 0.3 eV. Some properties of these cells are discussed, attention being paid in particular to the influence of oxygen in the ambient gas. A.

537.311.33 : 621.314.63

387. ON OPEN CIRCUIT TRANSIENT EFFECTS IN POINT-CONTACT RECTIFIERS. H.L.Armstrong.
J. appl. Phys., Vol. 27, No. 4, 420-1 (April, 1956).

Presents an analysis in terms of hemispherical p–n junctions for the open-circuit voltage which appears across a rectifier following a pulse of current in the forward direction. The results have applications to point-contact and gold-bonded diodes. C.A.Hogarth

537.311.33 : 621.314.63

388. AVALANCHE BREAKDOWN VOLTAGE IN SILICON DIFFUSED p-n JUNCTIONS AS A FUNCTION OF IMPURITY GRADIENT. H.S.Veloric, M.B.Prince and M.J.Eder.
J. appl. Phys., Vol. 27, No. 8, 895-9 (Aug., 1956).

A method is presented for controlling the reverse breakdown voltage (V_B) in a silicon graded junction. The significant process parameters are shown to be resistivity, time of diffusion and temperature of diffusion. For a constant resistivity, V_B increases with the fourth root of the time of diffusion and with the square root of the depth of diffusion as predicted by theory. Statistical analysis shows that the mean breakdown voltage for a large group of units can be predicted within 2%. The method fails for very low or high resistivity material.

A.

537.311.33

389. NOTE ON TURNOVER IN GERMANIUM CONTACTS. P.T.Landsberg.
Proc. Phys. Soc. B, Vol. 69, Pt 7, 763-5 (July, 1956).

The known dependence of power dissipation at turnover on ambient temperature is an important restriction on the isothermal characteristics of germanium contacts. It is shown that the admissible class of characteristics is rather wider than had previously been thought. P.T.Landsberg

537.311.33

390. THE BEHAVIOUR OF p–n JUNCTIONS AT HIGH CURRENT DENSITIES. A.Herlet.
Z. Naturforsch., Vol. 11a, No. 6, 498-510 (June, 1956). In German.

The characteristics of simple p–n junctions are considered for high current densities i when Shockley's assumptions are no longer valid. The differences arise in part from the unlimited minority carrier concentrations which can occur. The voltage drop in the bulk of either side of a symmetrically doped p–n junction increases with $\sqrt{i}$ while the voltage drop over the space charge region tends to the limiting diffusion potential V_D. These considerations lead to a current–voltage characteristic of the form $i \propto (U-V_D)^2$ where U is the applied voltage. C.A.Hogarth

537.311.33 : 621.314.63

391. A STUDY OF THE RECTIFYING PROPERTIES OF p–n JUNCTIONS BETWEEN SELENIUM AND THE SULPHIDES AND SELENIDES OF TIN. V.R.Grimm and D.N.Nasledov.
Zh. tekh. Fiz., Vol. 26, No. 4, 707-15 (1956). In Russian.

Rectification has been observed at p–n junctions between Se and SnSe, Sn_2Se_3, $SnSe_2$ and SnS. Fabrication details are given. The rectification characteristics, temperature dependence, stability, reliability and overload properties were studied. Advantages over conventional Se rectifiers are claimed. J.B.Arthur

537.311.33 : 539.132

HYDROGEN-LIKE MODEL OF THE VALENCY IN SEMICONDUCTING COMPOUNDS OF THE TYPE $A^{III}B^{V}$.
See Abstr. 595

537.311.33 : 545

COMPARISON OF SOME METHODS FOR THE DETERMINATION OF TRACE IMPURITIES IN SEMICONDUCTORS.
See Abstr. 840

537.311.35

392. A SIMPLE D.C. METHOD FOR THE DETERMINATION OF THE ELECTRICAL RESISTANCE OF GLASS. H.E.Taylor.
J.Soc. Glass Technol., Vol. 39, 193T-204T (Aug., 1955).

A simple apparatus for the measurement of the d.c. conductivity of glasses at low temperatures is described. In order to make observations at low currents a pH meter is used, a range of measurement of specific resistances from 10^8 ohm. cm to 5×10^{12} ohm. cm being possible, using the instrument in its original form. A modification of the pH meter permits this range to be extended up to a specific resistance of 10^{15} ohm. cm. Typical results obtained with the apparatus are given. A.

537.311.4

393. ON THE MECHANISM OF THE VOLTAGE DEPENDENT CONTACT RESISTANCE OF SILICON CARBIDE. W.Heywang.
Z. angew. Phys., Vol. 8, No. 8, 398-405 (1956). In German.

Analyses the energy diagram for SiC–SiC contacts under the influence of a wide range of electrical fields which can cause tunnelling and also, by raising the temperature of the contact, can allow charge carriers to leak through the barrier. Theoretical I–V curves are obtained in good agreement with experiment. C.A.Hogarth

537.312.5 : 537.531.9

394. THE INFLUENCE OF X-RADIATION ON THE ELECTRICAL CONDUCTIVITY OF PHOTOSENSITIVE PbS AND Tl_2S LAYERS. B.Buras and A.Zaręba.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 3, No. 8, 425-7 (1955).

Layers of the photoconductive materials are prepared by evaporation in vacuo and subjected to X-radiation. Highly light-sensitive layers also respond to X-rays but low-sensitivity layers show little response to X-radiation. The results are assumed to favour the barrier layer theory of photoconduction in PbS and Tl_2S. G.F.J.Garlick

537.312.5

395. PHOTOCONDUCTION IN CALCIUM METAANTIMONATE. J.Janin and L.Cotton.
C.R. Acad. Sci (Paris), Vol. 243, No. 6, 580-2 (Aug. 6, 1956). In French.

Various test cells were examined made of the basic material, and of the material activated with lead, manganese and bismuth. The effects in $CaSb_2O_6$ (Pb) are due to excitation of electrons from the luminescence centres to the conduction band. For the other materials the effects are restricted to the luminescence centres. Other centres in the forbidden band, not luminescent ones, are responsible for the long wave sensitivity observed. C.A.Hogarth

537.312.5 : 537.311.33

396. BULK PHOTOVOLTAIC PHENOMENON. Z.Trousil.
Czech. J. Phys., Vol. 6, No. 1, 96-8 (Jan., 1956).

Experimental observation of the non-barrier photovoltaic effect predicted by Tauc (Abstr. 7970/1955) is claimed. A scan of photo-voltage along a Ge specimen (~50 ohm. cm, p-type, etched to give low surface recombination) showed a 12.5 mV peak in the vicinity of the maximum change in resistivity (measured by a probe method). A similar specimen, with very small variations in resistivity, showed appreciable and smooth changes in photovoltage. It is suggested that the effect can give a sensitive indication of small scale inhomogeneities. C.H.L.Goodman

537.312.5 : 621.383.2

397. FLICKER NOISE IN VACUUM PHOTOELECTRIC DIODES. R.J.J.Zijlstra and C.T.J.Alkemade.
J. appl. Phys., Vol. 27, No. 6, 656-7 (June, 1956).

Experimental results showing the existence of an f^{-1} noise output for f = 1 to 200 c/s are reported. This is interpreted as a flicker noise arising from the variations in resistance of a cathode layer. A.H.W.Beck

537.312.5

398. PHOTOCONDUCTIVITY OF LEAD SULFIDE FILMS. G.W.Mahlman.
Phys. Rev., Vol. 103, No. 6, 1619-30 (Sept. 15, 1956).

Extensive experimental data have been taken on thin photoconducting films of lead sulphide of the chemically-oxidized type. Conductivity of the films in the temperature range 77°-300°K depends greatly on the amount of oxidation received by the films. Activation energy approaches a maximum value of 0.35 electron volt, but may have any value down to zero depending on the temperature range, amount of oxidation, and the illumination. Time constants as well as conductivity have been measured at different temperatures and illuminations, and in general tend toward a reciprocal relationship though the detailed behaviour is more complicated than a simple reciprocity. Other important properties measured include spectral response and transient response to large changes in illumination. A.

537.312.5

399. BARRIER THEORY OF THE PHOTOCONDUCTIVITY OF LEAD SULFIDE. J.C.Slater.
Phys. Rev., Vol. 103, No. 6, 1631-44 (Sept. 15, 1956).

The barrier theory of the infrared photoconductivity of PbS films is discussed, according to which the high resistance of the films arises from n-p-n barriers at the surfaces between the crystallites forming the films, the barriers being formed in the oxidizing process used in preparing the films. Under the action of light, electron hole pairs are formed, these carriers become trapped in the n- and p-type regions, respectively, the resulting charge density lowers the barriers, and hence the conductivity is increased. This theory is worked out quantitatively, and compared with experimental results of

Mahlman on films of the type actually used as sensitive photoconductors. The theory shows good qualitative and quantitative agreement with experiment in numerous respects, including the explanation of the dark conductivity of the films and its dependence on temperature, the photoconductivity as a function of irradiance and temperature, the time constants involved in the rise or decay of the photoconductivity, and the short-wave limit of the photoconductivity. In working out the theory of the barrier model, the properties of the bulk material as determined by Petritz and Scanlon are used, and the properties of the films are found to be consistent with knowledge of the behaviour of the bulk material. A.

537.312.5

400. THE HAMAKER–BEEZHOLD EFFECT. DETAILED STUDY OF THE PHENOMENON AND OF THE POSSIBILITIES OF SUPPRESSING IT. G.Blet and A.Ritti.
Rev. Opt., Vol. 35, No. 4, 193-214 (April, 1956). In French.

The effect so named is the rise and decay of photocurrent in photovoltaic cells (selenium barrier layer cells). The variation of rise and decay of current with light intensity and wavelength is measured. Determinations are made from the current rise and decay of the number of trapping states per unit area of the barrier surface (10^{10}/mm^2). The effect is eliminated by the use of modulated light (> 10 c/s), due to saturation of trapping states. G.F.J.Garlick

537.312.5

401. ON THE DARK- AND PHOTOCONDUCTIVITY OF ANTHRACENE. H.J.Zinszer.
Z.Naturforsch., Vol. 11a, No. 4, 306-11 (April, 1956).

The conductivity in the dark is very small for electrodes pressed on to the crystal surfaces and space charge effects occur, particularly during illumination. Electrodes evaporated on to the crystal give rise to much larger dark- and photo-currents but space charge effects are smaller and do not persist for long times. The photoconductivity is reduced by alpha-particle bombardment of the crystals. G.F.J.Garlick

537.312.5

402. ELECTRON MICROSCOPE STUDY OF THE STRUCTURE OF PHOTOCATHODES. A.I.Frimer and A.M.Gerasimova.
Zh. tekh. Fiz., Vol. 26, No. 4, 726-32 (1956). In Russian.

The method of Abstr. 6204 (1949) was used to study the correlation between sensitivity and structure of photocathodes of O–Cs, Sb–Cs and Bi–Cs. The method permits the study of the structure at various stages and reveals that non-homogeneity arises in O–Cs layers during the reduction process. The most uniform (and most sensitive) cathodes studied were translucent layers of powdered Ag on a thin, heavily oxidized Ag base. Sb–Cs also has a homogeneous structure and good sensitivity but Bi–Cs has not, due to a too rapid crystal growth occasioned by the low melting point of Bi. The introduction of Ag or Sb inhibits fast crystal growth and increases sensitivity. J.B.Arthur

537.312.5

403. STRUCTURE OF THE SPECTRAL CURVE OF THE INTERNAL PHOTOEFFECT IN CADMIUM SULPHIDE CRYSTALS. E.F.Gross, A.A.Kaplyanskiĭ and B.V.Novikov.
Zh.tekh. Fiz., Vol. 26, No. 4, 913-16 (1956). In Russian.

Further evidence of excitonic phenomena in CdS crystals was furnished by the observation of a number of peaks (near the main absorption edge) in the photoconductive response spectrum (polarized light at 77.3° K). These peaks coincided with lines or bands in the corresponding absorption spectrum. Their height depended on the angles of incidence and polarization of the incident light relative to the c-axis of the crystal. C.H.L.Goodman

537.312.5

404. PHOTOELECTRONIC EMISSION FROM CdS. Yu.A.Shuba.
Zh. tekh. Fiz., Vol. 26, No. 5, 1129-35 (1956). In Russian.

Thin evaporated layers of mixed cubic and hexagonal CdS were studied. The work function was ≤ 4.1 eV but quantum efficiency was $< 10^{-7}$ for 5 eV excitation and increased but slowly with photon energy. The photoelectron energy distribution was independent of photon energy in the range 5 to 6.5 eV. Emission was markedly increased by simultaneous exposure to intense visible light ($h\nu > 2.5$ eV); long wave radiation ($h\nu < 2$ eV) decreased it. The results were interpreted in terms of an exciton mechanism for photon–electron interaction. C.H.L.Goodman

537.312.5

405. ENERGY DISTRIBUTION OF PHOTOELECTRONS IN THE EXTERNAL PHOTOEFFECT OF THE ANTIMONY–CAESIUM PHOTOCATHODE. Yu.K.Shalabutov and N.S.Maslennikova.
Zh. tekh. Fiz., Vol. 26, No. 6, 1166-9 (1956). In Russian.

An investigation of anomalies in spectral response in the 500-600 mμ region. Photoelectrons excited by 530 mμ radiation were found to occur in two groups with mean energies of about 0.2 and 0.6 eV. This could be understood in terms of an exciton mechanism of excitation. C.H.L.Goodman

537.312.5

406. ON THE CONSTANCY OF SPECTRAL CHARACTERISTIC OF OXYGEN–CAESIUM AND ANTIMONY–CAESIUM VACUUM PHOTOELEMENTS. V.S.Khazanov and C.G.Yurov.
Zh. tekh. Fiz., Vol. 26, No. 6, 1170-3 (1956). In Russian.

A study of the effect of applied voltage on spectral response Sb–Cs cells showed enhanced red sensitivity above 1 kV. O–Cs cells showed a slight general improvement in sensitivity at 3 kV. C.H.L.Goodman

537.312.5

407. ON THE PHOTOCONDUCTIVITY OF BORIC ACID. G.Wendel and G.Richter.
Z. phys. Chem. (Leipzig), Vol. 205, No. 3, 175-7 (Jan., 1956). In German.

Photoconductivity, apparently n-type, is found in crystalline boric acid and in that prepared from the melt. The photocurrent shows a saturation effect with increasing applied field strength but is linear with excitation intensity, response occurring at wavelengths ≤ 2537 A. G.F.J.Garlick

537.312.62

408. ON THE SIZE OF THE CRITICAL CURRENT IN THIN SUPERCONDUCTING FILMS. L.A.Feĭgin and A.I.Shal'nikov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 823-4 (1956). In Russian.

Critical currents for destruction of superconductivity in tin films (3.4 to 21 x 10^{-6} cm thick) evaporated in high vacuum on to glass cylinders of about 0.5 mm diameter have been measured. For a film 4 x 10^{-6} cm thick, the field of the critical current at the film surface was about 3 Oe at 2° K, and above 3° K fell off linearly to zero at a transition temperature of about 3.8° K. These fields are much less than predicted by the Ginsburg-Landau theory. D.Shoenberg

537.312.62

409. SUPERCONDUCTING TRANSITION IN ALUMINUM. J.F.Cochran, D.E.Mapother and R.E.Mould.
Phys. Rev., Vol. 103, No. 6, 1657-69 (Sept. 15, 1956).

Techniques have been developed which make it possible to examine the detailed properties of the superconducting transition under rigorously isothermal conditions down to temperatures of about 0.8° K. The superconducting behaviour of an accurately ellipsoidal single crystal of pure aluminium has been studied by using a high-precision ballistic induction method which is particularly well suited for studying the reversibility of the transition. The problem of accurately determining the thermodynamic critical field, Hc, from magnetic induction measurements is discussed. The experimental results show that aluminium always supercools by a substantial amount if the applied magnetic field is reduced from a value greater than a characteristic value, H_n, which is the field necessary to destroy the last detectable trace of superconductivity in a super to normal transition. The value of H_n appears to be slightly greater than H_c. Some aluminium specimens are found to exhibit two discreet supercooled transition fields depending upon the magnitude of the excursion in the applied field beyond H_c. This effect (termed the quench effect) appears to indicate that the superconducting phase can survive in microscopic regions within the specimen at fields far abouve the critical field, and it is possible to determine quite accurately the field, H_q, which is necessary to quench such local regions. The available evidence is consistent with the model proposed by Faber according to which the persistent superconducting traces are associated with localized strain configurations in the metallic lattice. A.

537.312.62

410. A GENERAL THEORY OF MEISSNER EFFECT. T.Matsubara.
Progr. theor. Phys., Vol. 13, No. 6, 631-2 (June, 1955).

Introducing an external magnetic field and using Anderson's technique (Abstr. 6276/1954) the method of Abstr. 8299 (1956) is applied to the theory of the Meissner effect. The resulting relation between the current and the magnetic field is the same as that given by London's equation. W.A.Hepner

537.312.62

411. CHANGE OF LENGTH IN LEAD AT THE DESTRUCTION OF SUPERCONDUCTIVITY. P.Grassmann, J.L.Olsen and H.Rohrer.
Z. Naturforsch., Vol. 11a, No. 7, 609-10 (July, 1956). In German.

The change of length, $(l_S - l_n)/l_n$, was measured between 1.75° and 4.2°K, giving an extrapolated value of 1.65×10^{-7} at T = 0°K. From these data the pressure dependence of the critical magnetic field $(\partial H_C/\partial p)_T = (7.8 \pm 0.6) \times 10^{-9} + (4 \pm 2) \times 10^{-9} (T/T_C)^2$ oersted.dyne^{-1}cm^2 was calculated. H.London

537.312.62

412. THE STABILITY OF THE BOUNDARY BETWEEN THE NORMAL AND THE SUPERCONDUCTING PHASE. I.E.Dzyaloshinskiĭ.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1154-5 (1956). In Russian.

In reply to the view put forward by Beck (Abstr. 6156/1955) the author invokes the theory of Ginzburg and Landau (Abstr. 1017/1952); it is shown that the boundary between the normal and the superconducting phase is stable. R.Eisenschitz

537.312.62

413. STRUCTURE OF THE INTERMEDIATE STATE OF SUPERCONDUCTORS. B.M.Balashova and Yu.V.Sharvin.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 40-4 (1956). In Russian.

The structure of the intermediate state has been investigated by depositing a fine ferromagnetic powder on the surface of a tin sample. Two-dimensional structure patterns of various types have been obtained for various relative amounts of the normal phase in the sample. The influence of other factors, e.g. the mode of transition, temperature, sample dimensions etc. on the patterns has also been studied. A.

537.312.62

414. SUPERCONDUCTIVITY AND ELECTRICAL RESISTANCE OF NOVEL TIN–BISMUTH ALLOYS. W.Buckel and R.Hilsch.
Z. Phys., Vol. 146, No. 1, 27-38 (1956). In German.

These alloys are produced by simultaneous condensation from the vapour phase on a plate of crystalline quartz at 4°K. The electrical resistance and superconductivity of these layers as a function of their composition is investigated. A distinctly different behaviour is found in the two regions containing 0-45 and 45-100 atomic % Bi. In the first region the transition temperature rises to 6.7°K; in the second it decreases to 6°K, the established value of quenched condensed Bi. There is also a marked difference between the two regions on annealing. In the discussion it is shown that up to 45% Bi mixed crystals can be obtained (size > 100 A). At higher Bi concentration both components appear separately in a "superfine" crystalline state (size ~ 40 A). H.London

537.312.62 : 534.23

ULTRASONIC ATTENUATION AT LOW TEMPERATURE FOR METALS IN THE NORMAL AND SUPERCONDUCTING STATES. See Abstr. 181.

537.312.8

415. THE INFLUENCE OF SPONTANEOUS, TRUE AND FERROMAGNETIC MAGNETIZATION ON ELECTRICAL RESISTANCE. E.Böhringer.
Z. Phys., Vol. 146, No. 1, 65-74 (1956). In German.

Reports results of experiments on nickel between 88° and 505°K. It is found that $R - R_S = A\delta R \cos^2\theta$, where θ = the angle between the current and the spontaneous magnetization vector in a domain, δR = the temperature dependent ferromagnetic resistance anomaly and R_S and A are constants. The resistance change was also measured at fields above those required for technical saturation, and was found to be proportional to the field strength and to depend on the temperature. E.P.Wohlfarth

537.323

416. THERMOELECTRIC PROPERTIES OF THE COMPOUND $CrSb_2$. N.Kh.Abrikosov and V.F.Bankina. [Russian.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 627-8 (1956). In

Alloys with 80-85% (by weight) Sb were prepared by means of prolonged annealing. For the approximate composition $CrSb_2$ there was a maximum in thermoelectric power (−81 μV/deg C), and a minimum in conductivity (6.4 ohm^{-1}cm^{-1}) with thermal activation energies of 0.157 eV below and 0.32 eV above 350°C. C.H.L.Goodman

537.323

417. THERMOELECTRIC PROPERTIES OF BISMUTH. G.A.Ivanov and L.I.Mokievskiĭ.
Zh. tekh. Fiz., Vol. 26, No. 6, 1343-4 (1956). In Russian.

A study of the effect of temperature gradient on the thermoelectric power of pure (zone-melted) Bi. The room temperature value was found to be independent of the temperature difference across the specimen while this was varied from 0.01° up to 9°C. This contradicts the results of Sato (Abstr. 5426/1951) who found maxima in thermoelectric power for temperature differences of 0.8° and 5°C. C.H.L.Goodman

ELECTRIC DISCHARGES 537.52

537.52

418. HELMHOLTZ INSTABILITY OF A PLASMA. T.G.Northrop.
Phys. Rev., Vol. 103, No. 5, 1150-4 (Sept. 1, 1956).

A plasma having infinite electrical conductivity and no viscosity is assumed to be in contact with a uniform magnetic field along a plane boundary which is parallel to the field. The behaviour of small perturbations of this boundary when the plasma is flowing at velocity v_0 perpendicular to the magnetic field is calculated by linearized theory. Perturbations which only move lines of force parallel to themselves are unstable; for small v_0/c the motion is incompressible and the rate of growth of the perturbation can be obtained from the incompressible hydrodynamic expression by replacing the mass density of each fluid in the hydrodynamic case by the sum of twice the magnetic energy density divided by c^2 and the mass density of each magnetohydrodynamic fluid. The magnetic field is to be considered as a "fluid" having only magnetic mass. It is shown that this analogy holds even in the nonlinear equations for two-dimensional incompressible flow. Perturbations which only bend lines of force are stable, while those which both move lines parallel to themselves and bend them are stable if the bending wavelength is short enough. A.

537.521

419. THEORETICAL ANALYSIS OF BUILDUP OF CURRENT IN TRANSIENT TOWNSEND DISCHARGE. Y.Miyoshi.
Phys. Rev., Vol. 103, No. 6, 1609-18 (Sept. 15, 1956).

The buildup of current in the transient Townsend discharge has been calculated fully, taking the positive-ion and photon mechanisms at the cathode into account. The two cases of continuous and instantaneous electron supply have been treated. The calculated results are useful for the explanation of the buildup of current during the formative time lag of sparks under a sudden application of overvoltage, and for the transient state of a Townsend discharge in the case of undervoltage application. A.

537.523.4

420. SOME EFFECTS OF AN AIR BLAST ON SPARK DISCHARGES. B.Cragg and J.K.Hurwitz.
J. Opt. Soc. Amer., Vol. 46, No. 10, 889-95 (Oct., 1956).

A detailed spectroscopic investigation has been carried out on the "quenching" of a spark discharge and the removal of self-absorption by an air blast and choice of source conditions. It was found that the spectrum excited by an overdamped discharge was made more spark-like by an air blast, and was then very similar to that produced by an oscillatory discharge. It was concluded that an air blast blows out the arc-like discharge into which a spark degenerates. Furthermore, self-absorption was found to occur largely during this arc-like portion of the discharge. The use of an oscillatory discharge rather than an overdamped discharge was more effective in removing self-absorption than an air blast. A.

537.523.4

421. ON THE SPECTROSCOPIC MEASUREMENT OF THE

TEMPERATURE OF CONDENSED SPARK DISCHARGES. J.van Calker and H.Braunisch.
Z. Naturforsch., Vol. 11a, No. 7, 612-13 (July, 1956). In German.

A brief review of certain experimental data relating to the spectroscopic measurement of excitation temperatures. These temperatures vary up to about 33 000°K. J.D.Craggs

537.523.4

422. RATE OF DEVELOPMENT OF THE MAIN CHANNEL OF A LONG SPARK IN A ROD-ROD GAP. M.A.Bagirov.
Zh. tekh. Fiz., Vol. 26, No. 4, 755-8 (1956). In Russian.

The main channel in a rod-rod gap originates at the instant of meeting of the opposite leaders, shown by a sudden increase of the current in the oscillogram. In analogy with the lightning phenomenon, the main channel in the gap discharge is propagated towards both electrodes (cloud-earth). The propagation rate of the main channel does not remain constant along the gap, but increases to a maximum and then falls. Current and speed maxima do not coincide. Electrical Research Association

537.523.5 : 621.3.014.31

423. THE ASYMMETRY OF THE VOLTAGE IN A D.C. ARC. G.P.Skornyakov.
Izv. Akad. Nauk SSSR, Otdel. tekh. Nauk, No. 5, 140-3 (1956). In Russian.

The asymmetry of the arc voltage refers to the variation of the voltage on changing the polarity of a discharge with the arc current kept constant. Optical investigations with a spectrometer without slot show that the phenomenon is due to substantial changes in the composition of the vapours forming the arc cloud and contributing to the conductivity. This, in turn, is due to the change in the conditions of electrode evaporation owing to the changed polarity.

Electrical Research Association

537.523.5

424. ON THE EXPLANATION OF THE ANOMALOUS ROTATION OF ARCS. H.Pupke.
Naturwissenschaften, Vol. 43, No. 10, 222 (1956). In German.

Discusses the rotation of arc columns very briefly in terms of Maxwell's equation, and a modified equation invoking the magnetic susceptibilities of the charge carriers and the neutral gas. J.D.Craggs

537.523.5 : 536.23

425. ON AN EXPERIMENTAL AND THEORETICAL DETERMINATION OF THE THERMAL CONDUCTIVITY OF THE PLASMAS OF HIGH CURRENT CARBON ARCS. R.Wienecke.
Z. Phys., Vol. 146, No. 1, 39-58 (1956). In German.

The total conductivity, k, of an arc column as a function of temperature was calculated as the sum of the normal conductivity and that due to the diffusion of energy of reactions. By means of high time-resolution photography of the arc, estimates of the variation of the temperature of the arc with time after switching off the current were made. This enabled experimental values of k to be found for the range 4000 to 10 000° K. Comparison of the theoretical and experimental values of k shows general agreement at high temperatures, but that at lower temperatures the experimental value is higher. It is suggested that this is due to the existence of a relaxation time for atom-to-molecule recombination. J.Dutton

537.523.5

426. THE AFTERGLOW OF NITROGEN MOLECULES AT ATMOSPHERIC PRESSURE. K.Lehmann, H.Schulze and B.Winde.
Z. phys. Chem. (Leipzig), Vol. 205, No. 3, 178 (Jan., 1956). In German.

A brief note describing a streaming nitrogen arc (40 A current) showing strong afterglow effects. J.D.Craggs

537.525 : 537.531

427. X-RAY EMISSION AT THE COMMENCEMENT OF A GAS DISCHARGE. I.M.Podgornyĭ.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 820-2 (1956). In Russian.

Electric discharges taking place in hydrogen were studied. Measurements on starting the discharge at various gas pressures showed the X-ray emission to be vanishingly small at about 1 mm Hg. The author uses Bethe's formula for ionization losses in order to interpret his results and concludes that, if the diffusion character of the motion of electrons is not taken into account, X-ray emission must be cut off at a hydrogen pressure of 1.3 mm Hg. If electron diffusion is taken into account then the X-radiation will be cut off at a somewhat lower pressure. C.R.S.Manders

537.525

428. RADIATION TEMPERATURE OF A PLASMA. F.Bitter and J.F.Waymouth.
J. Opt. Soc. Amer., Vol. 46, No. 10, 882-4 (Oct., 1956).

The radiation temperature of a plasma is defined for some one emission line as the temperature at which the ratio of the number of atoms in the upper or radiating state to that in the lower or final state is in equilibrium. This temperature is always less than the electron temperature but approaches it at high current densities. Two results first derived by de Groot are discussed in some detail. The first is that the maximum possible spectral intensity of the resonance radiation emitted by a plasma is the blackbody intensity at the electron temperature. The second is that the radiated line width is an approximately derivable function of the ratio of the penetration depth of the centre of the line to the lamp diameter. A procedure is given for estimating the electron temperature at high current densities. A.

537.525

429. OSCILLATIONS AND FLUCTUATIONS IN GAS DISCHARGES. K.G.Emeleus.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 3, 490-5 (1956).

Classifies the various forms of disturbances observed in low pressure tubes. Effects due to changes in the incremental circuit parameters, to electron oscillations and to ion oscillations are briefly discussed, and the physical mechanisms involved indicated. E.A.Ash

537.525 : 537.562

430. ELECTROACOUSTIC WAVES IN A GAS DISCHARGE PLASMA WITH CONSIDERATION OF VOLUME RECOMBINATION. M.V.Konyukov and Ya.P.Terletskiĭ.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 874-6 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 742-4 (July, 1956).

Deals briefly with the theory of electroacoustic waves in a partially ionized gas, and in particular with the effects of volume recombination and diffusion to the discharge tube wall. J.D.Craggs

537.525.8

431. GASEOUS DISCHARGE TUBES AS STANDARDS IN NOISE MEASUREMENT IN THE CM-WAVELENGTH RANGE. W.Klein and W.Friz.
J. Electronics, Vol. 1, No. 6, 589-600 (May, 1956). In German.

Discusses the relation between the microwave noise temperature and the electron temperature in low-pressure glow discharges in thermo-dynamical terms. A quantitative theoretical treatment is given. J.D.Craggs

537.525.8

432. FORMATION OF ELECTRON BEAMS IN H.F. DISCHARGES AND SOME RELATED PHENOMENA. N.Skogen.
K. Norske Vidensk. Selsk. Forhandl., Vol. 27, Paper 7, 33-6 (1954).

Describes various discharge tube arrangements (d.c. and h.f. a.c.) using pierced electrodes or localized tube constrictions in which beams of charged particles may be produced in regions outside that occupied by the discharge. J.D.Craggs

537.527

433. THE PROPERTIES OF HIGH-PRESSURE STEADY-STATE DISCHARGES IN HYDROGEN. W.A.Gambling and H.Edels.
Brit. J. appl. Phys., Vol. 7, No. 10, 376-9 (Oct., 1956).

The results of a large number of measurements of total voltage, voltage gradient, current density and excitation temperature over a range of current, pressure, gap length and electrode condition for high-pressure steady-state discharges in hydrogen are given. Tungsten and copper electrodes were used as these are typical refractory and non-refractory materials respectively. The results show that in the absence of metal vapour the cathode and column regions are quite independent, the state of one not affecting that of the other. With increasing current a change from the glow to an arc column occurs at a critical value of the gas temperature. At short gaps the column transition current is modified by heat transfer with the electrodes. With tungsten electrodes, increase in current causes a continuous transition between glow and

arc at the cathode which is due to thermionic emission. With copper electrodes the cathode transition is discontinuous, erratic and independent of cathode temperature, being a function rather of the surface condition. A.

537.527.5

434. MEASUREMENTS ON ARC DISCHARGES IN NITROGEN AT 1 ATM AND HIGHER PRESSURE. P.J.Somers and J.A.Smit.
Appl. sci. Res. B, Vol. 6, No. 1-2, 75-91 (1956).

After preliminary experiments in different gases the arc between carbon electrodes in nitrogen is investigated more closely. The axial electric field strength between homogeneous carbon electrodes (mainly at 3-6 A and 1-4 atm) and also in arcs with KCl in the anode (at 4 A and 1-5 atm) proves to be a linear function of the pressure. The field strength is higher than in air and is reduced by the KCl. The sum of cathode- and anode-fall is found to be independent of the pressure. The central temperature in the arc without KCl was hard to measure, because self-absorption influenced the intensity ratios of the molecular bands in the spectrum. With KCl this difficulty did not appear, and temperatures were measured of about 7000°K, slightly increasing with the nitrogen pressure. Because the carbon electrodes evaporate much more slowly than in air, the arc in nitrogen is less stationary than in air; this hindered the measurements. A.

X-RAYS 537.531

537.531 : 535.33

435. ON THE K SPECTRUM OF ALUMINIUM AND ITS OXIDE. B.Nordfors.
Ark. Fys., Vol. 10, Paper 21, 279-89 (1956).

An X-ray tube with two targets has been constructed, making it possible to obtain suitable reference lines in an easy way. In the K spectrum of aluminium and its oxide the lines α_2, α_1, α_3, α_4 and β have been recorded and measured. The difficulty of avoiding oxidation of an aluminium target is discussed. An interesting change in intensity and line shape of the satellite lines α_3 and α_4 in oxide as compared to metal is reported and discussed. A.

537.531 : 535.33/.34

436. DEPENDENCE OF LIMIT OF RESOLUTION ON BACKGROUND INTENSITY, DETECTING INSTRUMENT AND STAGE OF RESOLUTION IN X-RAY SPECTRA. D.C.Purkayastha.
Indian J. Phys., Vol. 30, No. 5, 250-4 (May, 1956).

Ditchburn has suggested that a combination of stage of resolution desired and the detecting instrument is characterized by C, the ratio of the minimum to maximum of resultant intensity pattern of two spectral lines, for optimum resolution. An expression relating k, the ratio of background intensity to the intensity of two X-ray spectral lines of half-width b, to the limit of resolution $\Delta\lambda_r$ is given. A table giving the values of b, $b/\Delta\lambda_r$ for various values of k and C has been constructed. A.

537.531 : 535.343

437. SOFT X-RAY ABSORPTION EDGES OF METAL IONS IN COMPLEXES. I. THEORETICAL CONSIDERATIONS. F.A.Cotton and C.J.Ballhausen.
J. chem. Phys., Vol. 25, No. 4, 617-19 (Oct., 1956).

The effect of crystal field symmetry on the appearance of K X-ray absorption edges of metal ions in complexes is considered. In particular, the splitting of 1s—4p absorption for first row transition elements is related to the splitting of the degeneracy of the 4p energy levels in the ion by the crystal field. A.

537.531 : 535.343

438. SOFT X-RAY ABSORPTION EDGES OF METAL IONS IN COMPLEXES. II. Cu K EDGE IN SOME CUPRIC COMPLEXES. F.A.Cotton and H.P.Hanson.
J. chem. Phys., Vol. 25, No. 4, 619-23 (Oct., 1956).

It is shown that the crystal field splitting of the 4p orbitals of Cu(II) in some complexes can be correlated with the splitting of the 1s—4p transition observed in studies of the K absorption edges of these complexes, provided the ligand—metal bonding is not appreciably covalent. A.

537.531

439. ENERGIES OF π-MESONIC X-RAYS. M.Stearns and M.B.Stearns.
Phys. Rev., Vol. 103, No. 5, 1534-44 (Sept. 1, 1956).

The energies of the 2p — 1s X-rays from the π-mesonic atoms from Li to F have been measured to $\frac{1}{2}$% or better. All the measured energies were lower than those calculated from the Klein—Gordon equation assuming a point-charge Coulomb field and corrected for finite size effects and vacuum polarization. (These are the only non-negligible electromagnetic corrections.) This indicates that the net nuclear interaction between a meson in the 1s orbit and a nucleus is repulsive. The energy shifts varied in a fluctuating manner from 3.4% for Li to 11.7% for O and 11.4% for F. If we assume that the shift arises from a scattering type potential, and further, that the effects of the individual nucleons are simply additive, then values for the s-wave scattering lengths a_1 and a_3 can be obtained by a least squares fit to the data. The values of a_1 and a_3 obtained in this manner are $a_1 = 0.14_5\lambda_\pi$ and $a_3 = -0.10\lambda_\pi$. The K_α energies of the isotopes B^{10} and B^{11} were measured separately, thus giving a direct determination of a_3 under the previous assumptions. This value for a_3 is $(-0.12 \pm 0.02)\lambda_\pi$. The energies of π-L_α X-rays for Si, Cl, K and Ca were also measured but with lesser accuracy. They were all found to agree with the calculated energy values to within 1% or better. A rough measure of the width of the B^{10} K_α line was also obtained. A.

537.531 : 539.264

440. X-RAY ATTENUATION IN LEAD, ALUMINUM, AND CONCRETE IN THE RANGE 275 TO 525 KILOVOLTS. W.Miller and R.J.Kennedy.
Radiology, Vol. 65, No. 6, 920-5 (Dec., 1955).

Experimental results are given for narrow and broad beam attenuation in the three materials at 275, 325, 425 and 525 kV. The mechanism of the X-ray attenuation and the build-up factor is explained. L.E.Mussell

537.531

441. BEAM QUALITY DETERMINATIONS FOR A 2-MVP RESONANCE TYPE X-RAY GENERATOR. N.A.Baily and N.S.Beyer.
Radiology, Vol. 66, No. 4, 572-6 (April, 1956).

The half-value layer (mm lead) has been measured for three different initial filtrations of the beam and at three distances from the X-ray tube target. The results show a change of quality with distance which is attributed to forward scatter from the lead diaphragms used to collimate the beam. J.R.Mallard

537.531 : 535.43 : 532.7

X-RAY SCATTERING BY LIQUID-METAL ALLOYS; A KINETIC APPROACH. See Abstr. 146

537.531 : 537.525

X-RAY EMISSION AT THE COMMENCEMENT OF A GAS DISCHARGE. See Abstr. 427

537.531.08 : 539.166.08

442. PHOTOGRAPHIC BADGES FOR THE ESTIMATION OF THE QUALITY OF X AND GAMMA RADIATION. B.W.Soole.
Brit. J. Radiol. Vol. 24, 450-4 (Aug., 1956).

Previous workers' results on using secondary electrons from irradiated metal surfaces for indicating quality of the incident radiation are discussed. The present method records backscattered electron emission from a thin Pb foil differentially absorbed through a tissue paper step wedge. Densitometer readings over the stepped blackenings are plotted as % electron stopping power against thickness of wedge. Distinct variation of the slopes of these curves with half-value layer of the incident radiation is shown. The wedge for X-rays is 1.08 – 5.68 mg/cm^2 thickness, that for Co^{60} gamma rays 1.7 – 215 mg/cm^2. D.V.Mabbs

537.531.08 : 771.534.56

443. RECIPROCITY LAW FOR X-RAYS. I. VALIDITY FOR HIGH-INTENSITY EXPOSURES IN THE NEGATIVE REGION. M.Ehrlich and W.L.McLaughlin.
J. Opt. Soc. Amer., Vol. 46, No. 10, 797-800 (Oct., 1956).

A 50 kV beryllium window X-ray tube was used to confirm the validity of the reciprocity law for X-radiation over an exposure rate range from approximately 0.033 r/sec to approximately 1100 r/sec for the ascending branches of the characteristic curves of two widely used radiation monitoring films. A

fast rotary shutter producing pulses of ten microseconds in duration facilitated the coverage of this 1 : 30 000 range. Conventional X-ray development as well as surface and internal development were employed. From the absence of reciprocity-law failure in the ascending branches of the characteristic curves the conclusion is drawn that, under the present experimental conditions, luminescence does not compete with the photographic effect. A.

537.531.08 : 771.534.56

444. RECIPROCITY LAW FOR X-RAYS. II. FAILURE IN THE REVERSAL REGION. M.Ehrlich.
J. Opt. Soc., Amer., Vol. 46, No. 10, 801-4 (Oct., 1956).

Experimental data are presented that show the reversal behaviour of the characteristic curves for one commercial X-ray film as a function of X-ray exposure rate and establish the presence of reciprocity-law failure and intermittency effect in the reversal region. Under the present experimental conditions, lower exposure rates of X-radiation are seen to favour reversal while the opposite is shown to be the case for visible light. Earlier work with different types of emulsions and under different developing conditions mentions an effect with visible light similar to the one here obtained with X-rays; however, a satisfactory interpretation of the basic mechanisms involved is still lacking and further experiments are required to establish the connection between the effects of X-rays and visible light. A.

537.531.08

445. RADIATION DOSIMETRY IN BIOLOGICAL RESEARCH. J.E.Morgan and F.Ellinger.
Radiology, Vol. 66, No. 6, 877-86 (June, 1956).

Means for stabilizing the output of 220 kV and 250 kV X-ray sets are described, as well as a dose-rate monitor for a 2 MeV Van de Graaff generator. Apparatus for whole-body irradiation of animals with Co^{60} is also described. F.T.Farmer

CATHODE RAYS. POSITIVE RAYS
537.533/.534

537.533

446. EXPERIMENTAL TEST OF THE FIXED FIELD ALTERNATING GRADIENT PRINCIPLE OF PARTICLE ACCELERATOR DESIGN. L.W.Jones, K.M.Terwilliger and R.O.Haxby.
Rev. sci. Instrum., Vol. 27, No. 8, 651-2 (Aug., 1956).

It has been shown experimentally that particles can be accelerated in an annular machine with guide field constant in time, using alternating gradient focusing. Electrons were betatron - accelerated from 25 to 400 keV in an eight-sector magnet. For each magnet $H = H_0 (r/r_0)^{\pm 3.36}$, the positive-field magnets being azimuthally longer than the negative. The mean orbit radius went from 36 to 52 cm. Both pulsed and continuous beams were accelerated and the resonance frequencies of radical and vertical oscillations found in various magnetic field conditions. J.H.Fremlin

537.533

447. FARADAY-CUP MONITORS FOR HIGH-ENERGY ELECTRON BEAMS. K.L.Brown and G.W.Tautfest.
Rev. sci. Instrum., Vol. 27, No. 9, 696-702 (Sept., 1956).

Two Faraday-cup electron collectors have been developed which are capable of measuring the absolute integrated beam current of linear accelerators to better than 0.5% at electron energies ranging from 4 to 300 MeV. A description of these instruments is given and complete design criteria are offered which allow the extension of the range to BeV energies. A.

537.533.2

448. THE SECONDARY ELECTRON EMISSION FROM METALS UNDER THE ACTION OF IONS AND NEUTRAL PARTICLES. V.G.Tel'kovskiĭ.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 444-6 (1956). In Russian.

Study of the secondary electron emission (s.e.e.) of pure metals when their surface is bombarded by ions and neutral atoms with energies from a few keV to 120 keV. The graphs show that the ion charge does not change the coefficient of the s.e.e., consequently, the s.e.e. is determined solely by the energy of the incident particle and not by the charge. To verify this a series of comparative measurements were made on ions and neutral atoms of helium, nitrogen and argon. The results show that, under the same conditions and within the accuracy of the measurement, the s.e.e. under the action of neutral atoms coincides with the s.e.e. under the action of ions. Consequently, the theory of the potential extraction of the s.e.e. would appear invalid. Z.F.Wojnar

537.533.2 : 537.311.31 : 541.183

449. WORK FUNCTION AND ELECTRICAL CONDUCTIVITY OF HYDROGEN COVERED NICKEL FILMS. THE EFFECT OF CONTAMINATION. W.M.H.Sachtler.
J. chem. Phys., Vol. 25, No. 4, 751-2 (Oct., 1956).

Hydrogen was adsorbed on evaporated nickel films, and the change in electric conductivity and photoelectric emissivity was investigated. It was found that hydrogen adsorption on extremely clean nickel surfaces causes an immediate decrease in conductivity and an increase in work function. On contaminated films, however, the adsorption is slow and its effects on conductivity and work function are of opposite sign; i.e., work function is decreased and conductivity is increased. A.

537.533.2

450. CHEMICAL TEST TO REVEAL THE KRAMER EFFECT. E.Ferroni.
Research Correspondence, Vol. 8, No. 10, S 49-S 50 (Oct., 1955).

The polymerization of acrylonitrile by the OH radical is suggested as a sensitive test for the Kramer effect. A.H.W.Beck

537.533.2 : 548.5

451. ON THE EMISSION OF ELECTRONS DURING CRYSTALLIZATION. G.Bathow and H.Gobrecht.
Z. Phys., Vol. 146, No. 1, 1-8 (1956). In German.

This phenomenon was reported for Sb, Hg, and Wood's metal by previous authors. Careful experiments using a high vacuum system and a detector capable of counting as low as five electrons per cm^2 of crystal surface per minute are described. No electron emission during crystallization or phase transformations of several materials is observed. C.A.Hogarth

537.533.3 : 539.181

452. ELECTRON OPTICAL IMAGE OF AN ATOMIC BEAM. L.Marton, D.C.Schubert and S.R.Mielczarek.
J. appl. Phys., Vol. 27, No. 4, 419 (April, 1956).

A method for the visual presentation of atomic gas flow at very low pressures is described, employing the optical schlieren effect. An atomic beam is used as a perturbing object in an electron optical scheme, so that the electrons are scattered through small angles and form an image on a photographic plate. The technique includes the provision of a condenser lens and an accelerating field to increase photographic efficiency and image intensity. A.J.Mee

537.533.3

453. DISTRIBUTION OF ELECTRON DENSITY IN THE ELECTRON-MICROSCOPE IMAGE. I.G.Stoyanova.
Zh. tekh. Fiz., Vol. 26, No. 5, 990-5 (1956). In Russian.

It is shown that the fraction of the electrons transmitted by a scattering body of mass d $\mu g/cm^2$ is exp $(-ad/V)$, where V = the accelerating potential in kilovolts and a = 19 $cm^2 kV/\mu g$. This is then used to discuss contrast between specimens of different atomic weight. J.M.Hough

537.533.33

454. EXPERIMENTAL DETERMINATION OF FOCAL LENGTHS AND PRINCIPAL PLANES OF ASYMMETRIC ELECTRON EINZEL LENSES. C.W.F.Everitt and K.J.Hanssen.
Optik, Vol. 13, No. 9, 385-98 (1956). In German.

Focal length and principal point determinations of symmetrical lenses by the shadow method require two shadow pictures. Asymmetrical lenses, in general, require four. For the special case of the asymmetrical einzel lens, this number can be reduced to three. A simple experimental arrangement for measuring the properties of these lenses is described, and a few results are given. A.E.I. Research Laboratory

537.533.35

455. CORRECTION FOR PHOSPHOR BACKSCATTERING

IN ELECTRON SCINTILLATION SPECTROMETRY.
M.S.Freedman, T.B.Novey, F.T.Porter and F.Wagner, Jr.
Rev. sci. Instrum., Vol. 27, No. 9, 716-19 (Sept., 1956).

An iterative numerical integration procedure has been developed to correct both beta spectra and differential beta–gamma directional correlations for the effects of finite instrument energy resolution including the effect of backscattering from a scintillation detector. The method has been tested and found to reproduce the true spectral shape in the cases of Re^{186}, Au^{198}, Tl^{204}, and to allow separation of composite beta-spectra as in the case of W^{187}. Application of the method is limited to maximum beta energies exceeding 200 keV. A.

537.533.74

456. ELASTIC SCATTERING OF ELECTRONS AND POSITRONS BY POINT NUCLEI. J.A.Doggett and L.V.Spencer.
Phys. Rev., Vol. 103, No. 6, 1597-601 (Sept. 15, 1956).

The Mott cross-section has been systematically tabulated, by means of an electronic computer, for intermediate relativistic energies. Results are presented at 15^0 angular intervals for electrons and positrons, for Z = 6, 13, 29, 50, 82, and 92 and for energies 10, 4, 2, 0.7, 0.4, 0.2, 0.1, and 0.05 MeV. Intercomparisons with earlier results are presented, as well as a subsidiary tabulation of a function important in the limit $\theta \to 0$. A.

537.533.74

457. COULOMB SCATTERING OF RELATIVISTIC ELECTRONS BY POINT NUCLEI. N.Sherman.
Phys. Rev., Vol. 103, No. 6, 1601-7 (Sept., 1956).

The Mott series for the Coulomb scattering of electrons by point nuclei have been evaluated numerically with the aid of the UNIVAC computer. Calculations of the series for $F(\theta)$ and $G(\theta)$, the scattering cross-section, and the polarization asymmetry factor, $S(\theta) = \beta^{1/2}$, were performed for scattering by nuclei of charge Z equal to 80, 48 and 13 at ratios of electron velocity to light velocity, $\beta = v/c$, equal to 0.2, 0.4, 0.5, 0.6, 0.7, 0.8 and 0.9. The results are tabulated. A.

537.533.74

458. THE NUCLEAR SCATTERING OF 0.4 AND 0.5 MeV ELECTRONS IN COMPOSITE ALUMINIUM URANIUM FOILS.
B.Brown, E.Matsukawa and E.A.Stewardson.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 496-9 (June, 1956).

Measured at 90^0 and 105^0 by the use of transmission targets of uranium sputtered on to aluminium foils, the uranium cross-section was not significantly different from the theoretical values at either energy. This is surprising as several previous authors have found cross-sections at backward angles for heavy elements appreciably below those predicted. No corrections were made for multiple or double scattering but when the foil target was reversed only a small change occurred of the order of the experimental error. Checks using pure aluminium gave very good agreement with the theory. D.J.A.Prowse

537.533.79 : 539.166.835

459. THE LIFETIME OF POSITRONS ANNIHILATING IN ALUMINUM. G.Jones and J.B.Warren.
Canad. J. Phys., Vol. 34, No. 10, 1033-7 (Oct., 1956).

The absolute lifetimes of positrons decaying in aluminium and mica have been found to be $1.7 \pm 0.4 \times 10^{-10}$ sec and $2.4 \pm 0.4 \times 10^{-10}$ sec, in accord with the determination by Bell and Graham using a different technique. A.

537.533.79

460. ELECTRONIC MOTION IN GASES AND THE METHOD OF FREE PATHS. L.G.H.Huxley.
Proc. Phys. Soc. B, Vol. 69, Pt 7, 769-71 (July, 1956).

A brief discussion of certain formulae for the drift speed of electrons in gases, with special reference to, and comments on, the work of Jancel and Kahan (Abstr. 8102/1955). J.D.Craggs

537.533.8 : 539.166.835

461. HIGH-ENERGY INTERFERENCE EFFECT OF BREMSSTRAHLUNG AND PAIR PRODUCTION IN CRYSTALS. H.Überall.
Phys. Rev., Vol. 103, No. 4, 1055-67 (Aug. 15, 1956).

With the use of monocrystalline targets for bremsstrahlung and pair production experiments, interference phenomena are expected to occur which will markedly change the γ-ray spectrum as well as the pair energy distribution, for certain angles giving enhancement of radiation and pairs. The effect increases with energy; it sets in at $\delta \sim < n_0(2\pi/a)$, where δ is the minimum momentum transfer to the target atoms, a = the lattice constant, and n_0 = a number of the order 2 or 3. This corresponds to ~ 200 MeV primary energy for bremsstrahlung, ~ 1 BeV for pair production. The effect is confined to angles between the primary beam and a line of atoms, of order $\theta \sim < (a_{screen}/\lambda_C)(mc^2/E)$. The temperature motion of the lattice reduces the interference effect to some extent. The Born approximation was used for the quantitative analysis of the problem. A.

537.533.8 : 539.166.835

462. BREMSSTRAHLUNG AND PAIR PRODUCTION IN CONDENSED MEDIA AT HIGH ENERGIES. A.B.Migdal.
Phys. Rev., Vol. 103, No. 6, 1811-20 (Sept. 15, 1956).

The effect of multiple scattering on bremsstrahlung and pair production is considered. The probability of these processes decreases considerably at energies $> \sim 10^{13}$ eV. The calculations are carried out with the aid of the density matrix. The formulae thus obtained yield the probability of pair production and bremsstrahlung for arbitrary electron and photon energies. A.

537.533.9

463. LIGHT SHIFTER FOR ČERENKOV RADIATION.
E.Heiberg and J.Marshall.
Rev. sci. Instrum., Vol. 27, No. 8, 618-19 (Aug., 1956).

Measurements are reported of the use of luminescent materials as a light shifter for Cherenkov radiation, with the object of increasing the pulse height from Cherenkov light observed by a photomultiplier tube. By this process the directional properties of the Cherenkov light are essentially lost. A.

537.534

464. RADIATION RESONANCE IN SYNCHROTRONS.
A.N.Matveev.
Zh. éksper. teor. Fiz., Vol. 30, No. 4, 804 (1956). In Russian.

Under the assumption that the quantum mechanical aspect of the radiation losses might be neglected, the conditions under which resonance occurs are found. In order to evaluate the order of magnitude of this effect, the results are fitted to a case in which a weak focusing synchrotron is considered. On the basis of a qualitative discussion it is shown that the resonance can be a cause of unsatisfactory operation of a synchrotron. G.Martelli

537.534

465. ON PASSAGE THROUGH THE CRITICAL ENERGY IN A STRONG FOCUSING ACCELERATOR. A.A.Kolomenskiĭ and L.L.Sabsovich.
Zh. tekh. Fiz., Vol. 26, No. 3, 576-84 (1956). In Russian.

Extensive investigation of the behaviour of the beam in strong focusing synchrotrons in the neighbourhood of the critical energy E_C. It is possible to go above the value of E_C if the phase of the electric accelerating field is shifted by $-2|\varphi_S|$ where φ_S is the equilibrium phase. The way in which the phase behaves near E_C as a function of time, and the best conditions to fulfill the above-mentioned relation are investigated. The case of perturbations which give rise to deviations from the linear theory is considered, and some qualitative conclusions are reached. G.Martelli

537.534.3

466. ON THE THEORY OF THE 90^0 MASS SPECTROMETER. I. IDEAL MAGNETIC FIELD. D.Charles.
Ann. Radioélect., Vol. 11, 249-67 (July, 1956). In French.

Simple theory is used to examine image formation for single and double collection; the influence of objective slit width, the required source stability and the tolerances on chromatic aberration are deduced. Second- and third-order aberrations are evaluated, and the simplest practicable conditions for second-order correction discussed. The influence on image formation of mechanical and electrical adjustments and mechanical tolerances is considered. N.M.King

537.534.3

467. DIRECT-COUPLED AMPLIFIER AND RATIOMETER FOR A SINGLE-BEAM MASS SPECTROMETER.
C.Reuterswärd.
Ark. Fys., Vol. 10, Paper 37, 501-24 (1956).

Design considerations and details of construction are given for an amplifier intended for precision measurements on isotopes of low abundance by rapid scanning of the mass spectrum. Further, for continuous accurate determination of iso-

tope ratio, the single-beam mass spectrometer is converted to a two-isotope ratio meter by combining an automatic switching device with a null method of comparing voltages. A.

537.534.3

468. A PULSED MASS SPECTROGRAPH. E.I.Agishev and N.I.Ionov.
Zh. tekh. Fiz., Vol. 26, No. 1, 203-8 (1956). In Russian.

The pulsed mass spectrograph designed by N.I.Ionov and B.A.Mamyrin (Zh. tekh. Fiz., Vol.23, 2101, 1953) has been improved so as to allow: (a) a better resolving power; (b) direct oscilloscopic observations of the spectrum of masses; (c) full elimination of the disturbances caused by the beam of electrons used to excite the gas. A detailed description of the mechanical and electronic components and a short theory of the device are given. G.Martelli

537.534.3

469. ON THE ELIMINATION OF THE CRITICAL ENERGY IN A STRONG FOCUSING SYNCHROPHASOTRON. A.A.Kolomenskiĭ.
Zh. tekh. Fiz., Vol. 26, No. 4, 740-8 (1956). In Russian.

With the help of a suitable matrix method an expression for the critical energy E_C is obtained as a function of the characteristic parameters of the machine. It is found that the best way to eliminate E_C consists in an appropriate distribution, along the magnet, of a number of sections having a "reverse curvature" (i.e. reverse magnetic field). This model is theoretically investigated and the results discussed quantitatively. G.Martelli

537.534.74 : 539.18 : 778.34

470. MASS MEASUREMENTS IN NUCLEAR EMULSIONS BY MULTIPLE SCATTERING AND GAP DISTRIBUTION. I.S.Mittra.
Indian J. Phys., Vol. 30, No. 7, 363-70 (July, 1956).

A method of identifying singly charged particles in nuclear emulsions with the help of gap distribution and multiple Coulomb scattering measurements for the same track is described. A parameter S depending upon scattering parameter $\bar{\alpha}_{100\,\mu}$ and gap distribution parameter g* is obtained, which is a logarithmic function of the mass. The observed values of S are in good agreement with the calculated ones. A.

537.534.74

471. p–He^3 SCATTERING AT 9.75-MeV PROTON ENERGY. R.H.Lovberg.
Phys. Rev., Vol. 103, No. 5, 1393-7 (Sept. 1, 1956).

The differential cross-section for the elastic scattering of 9.75 MeV protons from He^3 has been measured in the range of centre-of-mass angles from 30 to 150°. The cross-section varies from 345 millibarns/steradian at 30°, through a minimum of 18.2 mb at 110°, and rises to 84.5 mb at 150°. Comparison of the data with the distributions calculated theoretically by Swan gives only rough agreement, the closest being for ordinary forces in the four-body system. This conflicts with the good agreement obtained by Swan with the 14 MeV n–T data of Coon et al., in which a symmetric exchange force scheme was clearly preferable. A.

537.534.74

472. PROTON–PROTON SCATTERING EXPERIMENTS AT 170 AND 260 MeV. O.Chamberlain and J.D.Garrison.
Phys. Rev., Vol. 103, No. 6, 1860-70 (Sept. 15, 1956).

The differential proton–proton scattering cross-section has been measured at 170 and 260 MeV for laboratory angles of 4.4° to 30°. The proton beam was obtained by reducing the energy of the 345 MeV beam of Berkeley cyclotron. A liquid-hydrogen target was used. Counting was done with a telescope of two liquid scintillation counters. A Faraday cup served as a standard for beam calibration. The results indicate a cross-section, in the centre-of-mass system, independent of energy, and rather independent of angle, outside of the Coulomb region. The level of the differential cross-section is close to 3.6 millibarns per steradian. An approximate treatment indicates there is destructive interference between nuclear and Coulomb scattering. It is concluded that the real part of the nuclear scattering amplitude must be positive at small angles. A.

537.534.74

473. PROTON–PROTON SCATTERING AT 147 MeV. J.M.Cassels.
Proc. Phys. Soc. A, Vol. 69, Pt 6, 495-6 (June, 1956).

A remeasurement has been made of the 90° differential cross-section at 147 MeV. The scattered protons were detected by two scintillation counters in coincidence, the beam being monitored by a calibrated ionization chamber through which the protons passed before striking the targets. The value obtained, 4.05 ± 0.28 mb, is reasonably consistent with most other values. D.J.A.Prowse

537.534.75

474. MEASUREMENT OF ENERGY ABSORPTION BY IONIZATION CHAMBERS. E.W.Emery.
Brit. J. Radiol., Vol. 29, 370-6 (July, 1956).

The application of Gray's equation to the interpretation of ionization measurements in a small gas-filled cavity in terms of energy absorption, is discussed. Latest values for relative stopping power S_m, are given for many materials. Consideration of the Sternheimer "density effect" due to polarization in the medium traversed by a charged particle is given, and the extent to which this affects ionization measurements for different materials and radiation energies is indicated. The value to be ascribed to W, the energy required to produce an ion pair is fully discussed. Adequate references are given. D.V.Mabbs

537.534.8

475. BREMSSTRAHLUNG IN HIGH-ENERGY NUCLEON–NUCLEON COLLISIONS. R.E.Cutkosky.
Phys. Rev., Vol..103, No. 2, 505-6 (July 15, 1956).

For γ-ray energies so close to the end-point that the final nucleons are in an S-state, the spectrum can be calculated by a method similar to that used for the spectrum of π-mesons produced in nucleon - nucleon collisions. This calculation predicts a peak in the bremsstrahlung spectrum for high energy γ-rays. A.O.Stanesby

DISCHARGE TUBES. COUNTERS 537.54

537.542

476. THE CHARGE IN GEIGER–MÜLLER COUNTER PULSES AS A FUNCTION OF OVERVOLTAGE, FOR METALLIC AND GLASS CATHODES. S.Michalak and A.Zawadzki.
Acta phys. Polon., Vol. 15, No. 1, 63-70 (1956). In French.

Measurements were made of pulse sizes for various overvoltages, using circuit techniques which are described. These are compared with the theoretical treatment due to Wilkinson. J.D.Craggs

537.542 : 537.531.08

477. CONVERSION OF QUANTUM COUNTING RATE TO ROENTGENS. T.R.Kohler and W.Parrish.
Rev. sci. Instrum., Vol. 27, No. 9, 705-6 (Sept., 1956).

Expressions are derived relating counting rate measured with quantum detectors to the dosage rate in roentgens. The number of quanta/cm^2 per roentgen is strongly energy dependent. In the X-ray region 5 to 50 kV, however, the variation of the quantum counting efficiency with wavelength of some counters (e.g., argon Geiger counter) matches fairly closely the energy dependence factor, and hence such detectors can be used as r-meters. A.

537.542

478. AN IMMERSION BETA-RAY G.M. COUNTER. J.Wesołowski.
Acta. phys. Polon., Vol. 15, No. 2, 146-7 (1956).

A type of immersion beta-ray Geiger–Müller counter is described consisting of a glass tube with central wire anode, and in which the cathode consists of the liquid into which the counter is immersed. M.E.Haine

537.542 : 539.566.74

479. SOME OBSERVATIONS ON γ-RAY SCATTERING ROUND A SHADOW SHIELD IN WATER. C.C.Horton, J.R.Harrison, A.M.Mills and M.A.Hone.
Atomic Energy Res. Establ. (Harwell) Mem. No. RP/M67, 3 pp. (1955).

The γ-ray shield for the neutron flux ionization chambers used in the control of the Shielding Reactor consists of a shadow Pb shield of 4" thickness. It is shown that to remove effects due to backscattering of γ-radiation in the water, a Pb shield ⅞" thick is needed at the rear of the chambers. A.

537.542

480. ON THE WORK OF I. I. SHTEĬNBOK "BASIC

CHARACTERISTICS OF IONIZATION CHAMBERS". K.K.Aglintsev.
Zh. éksper. teor. Fiz., Vol. 30, No. 2, 429 (1956). In Russian.

The solution proposed by Shteĭnbok (Abstr. 6240/1955) for the equation which gives the current characteristics of an ionization chamber is not better (it is claimed) than solutions proposed by other authors. Shteĭnbok's solution has been obtained by assuming that the effect of the space charge might be neglected when the total ionization is weak: if one compares numerical values deduced from his theory with experimental data, this assumption and other approximations introduced by Shteĭnbok in his calculations seem to be wrong. G.Martelli

537.542

481. α-PARTICLE COUNTING BEHAVIOUR OF DIAMOND CONDUCTION COUNTERS AT FIELD STRENGTHS UP TO 200 kV cm^{-1}. K.W.Taylor.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 593-9 (Aug., 1956).

The general behaviour of a set of eighteen diamonds of size about 1 mm^3 was examined, particularly at applied field strengths from 10 kV cm^{-1} up to 200 kV cm^{-1}. The set includes all those high resistance types usually found in a sample of gem-quality diamonds. All the specimens were found to give conduction pulses and several specimens which were hitherto classed as non-counters for field strengths below 10 kV cm^{-1}, were found to give small conduction pulses for higher field strengths. The general counting behaviour was similar for all diamonds, although the magnitudes of the various effects varied over wide ranges from specimen to specimen and within each specimen. At higher applied field strengths two additional phenomena were apparent: the appearance of large pulses after a short period of counting and, on removing the applied field after a period of counting, the presence of depolarization pulses which were in the same direction as the normal counting pulses. The observed behaviour of all these specimens can be explained by assuming the presence of continuous spatial variations in trap density on a microscopic scale within each specimen. The mean of these microscopic variations varies over macroscopic distances within each specimen, and, also, from specimen to specimen. A.

537.542

482. XENON GAS SCINTILLATION FISSION COUNTER. H.Palevsky, R.L.Zimmerman and K.E.Larsson.
Rev. sci. Instrum., Vol. 27, No. 5, 323-4 (May, 1956).

537.542 : 621.474.33

483. A LINEAR GATE CIRCUIT FOR PULSE-HEIGHT ANALYSIS. H.Nauta.
Physica, Vol. 22, No. 4, 315-16 (April, 1956).

A gate circuit for microsecond pulses for use with a fast neutron spectrometer is described. The rejection factor, being the ratio of the output pulse magnitude with and without the gate pulse, can be varied up to a maximum of 70. The linearity is better than 4% for signals of 2 to 27 V amplitude.

Z.F.Wojnar

537.542

484. A NEW TYPE OF PULSE-HEIGHT ANALYSER UTILIZING A CATHODE-RAY TUBE WITH A PHOTO-TRANSISTOR SORTING ELEMENT. R.V.Gåsström.
Physica, Vol. 22, No. 7, 619-20 (July, 1956).

The pulses are displayed on a cathode-ray-tube screen and passed to a photo-transistor by means of an optical collimator placed in front of the screen. Display and sorting are thus electronically independent. Preliminary results are shown, using a NaI crystal, with Hg^{203}, Ce^{141} and Ce^{139}. J.D.Craggs

537.542 : 621.375.2 : 621.374.32

485. NONLINEAR AMPLIFIER DESIGN FOR PULSE-HEIGHT ANALYZERS. G.W.Hutchinson.
Rev. sci. Instrum., Vol. 27, No. 8, 592-6 (Aug., 1956).

The ratio of maximum to minimum pulse sizes which can be simultaneously recorded by a kick sorter is limited by the curvature of the characteristic of its biased amplifier over a finite region of input potentials. The extent of this region can be reduced from a few volts to about 10 millivolts by including the nonlinear elements of the amplifier in its negative feedback loop. An amplifier is described which embodies this principle and also provides a discriminator and gate circuit. A.

537.542 : 621.374.32

486. FILAMENTARY SUBMINIATURE SCALERS. C.C.Harris and P.R.Bell.
Rev. sci. Instrum., Vol. 27, No. 8, 608-10 (Aug., 1956).

In order to reduce the power requirements and heat dissipation in multichannel pulse-height analysers with parallel digital storage, the authors have devised and tested a low-wattage scale-of-two employing filamentary subminiature tubes. These units are designed for use in scales of 16 or 32 and exhibit great reliability and long life. The resolving time is 5 μsec with grid-catching diodes and 13 μsec unaided. For greater reliability in very long cascades and for battery operation, a Higinbotham version has been devised. Both designs promise extremely long life and may be useful wherever bistable switching circuits are used. A.

537.542

487. ARGONNE 256-CHANNEL PULSE-HEIGHT ANALYZER. R.W.Schumann and J.P.McMahon.
Rev. sci. Instrum., Vol. 27, No. 9, 675-85 (Sept., 1956).

The analyser, which has a magnetic core memory, uses a form of the Wilkinson method of generating numbers in response to input pulses. These numbers are proportional to the amplitudes of the input pulses, and correspond to the channel numbers into which the individual counts are to be recorded. The digital data processing circuits comprise a simple computer, with an internal memory which can store 256 sixteen digit binary numbers. A cathode-ray-tube display of the data in the form of a plot of counts v. channel number is available during and after operation. Permanent readout is in the form of a similar curve traced by a recording potentiometer. Printed decimal readout is also available. The normal average analyser dead time is 80 μsec, and pulse-rates in excess of 5 million per minute at the input circuit can be tolerated without appreciable data distortion. A.

537.542 : 539.185.08

488. 1024-CHANNEL NEUTRON TIME-OF-FLIGHT ANALYZER. R.W.Schumann.
Rev. sci. Instrum., Vol. 27, No. 9, 686-90 (Sept., 1956).

A 1024-channel time-of-flight analyser for recording data obtained in neutron time-of-flight experiments has been placed in operation at the Argonne National Laboratory. Channel widths are adjustable from $\frac{1}{2}$ μsec to essentially any higher value. The analyser dead time is 16 μsec following each recorded count. The storage circuits may be divided into two sections for recording events detected by two separate counters. The analyser may also be divided into four groups of 256 channels each. These groups may be independently located in any time region up to 4096 x T, where T is the channel width in use. Readout is by means of simultaneous teletype punched tape and analogue pen recording. There is a linear cathode-ray-tube display of counts v. channel number. The device uses a magnetic core memory system similar to that used in the 256 channel pulse-height analyser described in the preceding abstract. A.

537.542

489. ON THE DENSITY OF BUBBLES ALONG THE TRACK OF AN IONIZING PARTICLE IN AN OVERHEATED LIQUID. G.A.Askar'yan.
Zh. éksper. teor. Fiz., Vol. 103, No. 3, 610-11 (1956). In Russian.

A development of the elementary theory of nucleation of bubbles in overheated liquids along the path of ionizing particles. The author assumes that bubbles will form in those places where the condition for the formation of repulsive groups of complex ions is satisfied, i.e. where δ-rays have been generated. Under these assumptions and on the basis of statistical considerations it is found that the average bubble density $\bar{n} = Z^2\beta^{-2}\phi$, where Z = atomic number, β = relativistic velocity and ϕ = a given function of state of the liquid.

G.Martelli

537.542 : 539.172

LOW PRESSURE DIFFUSION CLOUD CHAMBER. See Abstr. 679

537.543 : 621.385.16.029.6

490. THEORY OF THE PREOSCILLATING MAGNETRON. II. PERTURBATIONS OF A DOUBLE STREAM STEADY STATE. G.D.Sims and D.Gabor.
J. Electronics, Vol. 1, No. 3, 231-62 (Nov., 1955).

For Pt 1 see Abstr. 6737 (1956). A discussion of the perturbations of a double stream steady state in a cylindrical magnetron. Using an expression for the electron density de-

rived from Liouville's theorem and taking finite emission velocities into account, an attempt is made to find a theoretical explanation of the phenomena discussed in Abstr. 754 B (1955), Proc. Instn Elect. Engrs, Paper No. 1760 R, publ. Jan., 1955 (102 B, 81-6). It is found that back bombardment and the noise characteristics of the magnetron can be explained qualitatively and frequencies are derived for which the back bombardment is a minimum. The importance of the type of first order oscillation found to exist, as regards the buildup of strong oscillation, is considered. G.D.Sims

537.543.029.6 : 621.385.16.029.6

491. THE RELATIVISTIC MAGNETRON AND THE EFFECTIVE MASS ANISOTROPY. L.Gold.
J. Electronics, Vol. 2, No. 1, 17-32 (July, 1956).

It is demonstrated that for the relativistic magnetron, an effective mass m^*/m_0 anisotropy arises in the cyclotron frequency similar to the cyclotron resonance phenomenon in semiconductors; values greater than or less than unity occur, with an anisotropy governed by the direction and magnitude of the particle injection velocity v_0 and the ratio of the electric and magnetic fields E/H. A special type of motion manifests itself for injection at 90° to E when $E/H = v_0/C$ and E_1H, which is associated with a singular solution for the trajectory. The cut-off relation is deduced for the cylindrical magnetron and the behaviour in the high energy limit found to be essentially different from the planar case with the cut-off voltage having an asymptotic value prescribed by the electron rest energy. A.

IONIZATION. THERMIONICS 537.56/.58

537.56

492. TEMPORAL GROWTH OF IONIZATION IN GASES. C.G.Morgan.
Phys. Rev., Vol. 104, No. 3, 566-71 (Nov. 1, 1956).

The temporal rate of growth of ionization in uniform electric fields E in hydrogen at pressures p was measured over a wide range of E/p between 50 and 400 V/cm.mm Hg when the values of the electric fields exceeded that corresponding to the static sparking field Es by a few percent. Comparison of the experimental data with a mathematical analysis of the growth based upon the action of primary and secondary ionization processes enabled the relative significance of the possible secondary processes to be assessed and their absolute values to be determined. These results showed that there was a change in the relative importance of the secondary processes as E/p changed. Thus, for low values of E/p (~ 50) the predominant secondary process was found to be photoelectric emission from the cathode, but as E/p was increased the relative importance of electron emission from the cathode due to the incidence of positive ions also increased until at high values (~ 300) 50% of the emission was due to this cause. At all values of E/p investigated, no single secondary process was exclusively responsible for the cathode emission. The investigation showed that the setting of the sparking criterion at $E = E_S$, as well as the early stages of ionization growth in the non-steady state when $E > E_S$, do not involve any significant action due to space charges. Such action occurs at a later stage of the growth, when the current density is allowed to increase to glow or arc discharge values. Author

537.561 : 537.583 : 536.423.15

IONIZATION POTENTIAL AND ELECTRON EMISSION OF PLUTONIUM. See Abstr. 316

537.562

493. CHARGE TRANSFER AND THE MOBILITY OF H^- IONS IN ATOMIC HYDROGEN. A.Dalgarno and M.R.C.McDowell.
Proc. Phys. Soc. A., Vol. 69, Pt 8, 615-23 (Aug., 1956).

The energies of interaction of H^- and H are calculated over a wide range of nuclear separations using molecular wavefunctions based upon various forms of atomic orbitals and those energies used for the calculation of the charge transfer and diffusion cross-sections of H^- ions in atomic hydrogen by the perturbed stationary state method. The charge transfer cross-sections decrease from 2×10^{-14} cm^2 at an impact energy of 1 eV to 0.3×10^{-14} cm^2 at 1000 eV and the diffusion cross-sections lead to values of the mobility of H^- ions in atomic hydrogen decreasing from 3.5 cm^2 V^{-1} sec^{-1} at 100°K to 1.8 cm^2 V^{-1} sec^{-1} at 600°K. A.

537.562

494. THE TEMPERATURE DEPENDENCE OF THERMAL IONIC POLARIZATION. L.N.Sȳrkin.
Zh. tekh. Fiz., Vol. 26, No. 6, 1163-5 (1956). In Russian.

Employing a single-particle model in one dimension electric moments as induced per unit of field strength are derived by simple statistical mechanics. Whereas it was assumed in previous theories that the potential energy barrier is high in comparison with the mean thermal energy, results obtained in the present paper apply to every ratio of these energies. R.Eisenschitz

537.564

495. ELECTRON ATTACHMENT IN SULFUR HEXAFLUORIDE USING MONOENERGETIC ELECTRONS. W.M.Hickam and R.E.Fox.
J. chem. Phys., Vol. 25, No. 4, 642-7 (Oct., 1956).

Electron attachment leading to the formation of SF_6^- and SF_5^- in sulphur hexafluoride has been investigated using nearly-monoenergetic electrons of established energies of less than 2 eV. The dissociative attachment process leading to the formation of SF_5^- maximizes at less than 0.1 eV and then decreases to zero at approximately 1.5 eV. In the case of resonance capture leading to the formation of SF_6^-, the capture process occurs at less than 0.1 eV and only over an energy range estimated to be not larger than 0.05 eV. This leads to an estimated cross-section for this resonance capture process of 10^{-15} cm^2. A discussion is given of the method used in the establishement of the electron energy scale at such low energies and the use of the resonance capture process for measuring electron energy distributions. A.

537.568

496. RECORDING DECAY OF ELECTRON DENSITY IN IONIZED GASES. G.E.Deakins and C.M.Crain.
Rev. sci. Instrum., Vol. 27, No. 8, 606-8 (Aug., 1956).

Describes a method for the measurement and photographic recording of electron density loss in an ionized gas utilizing a microwave system operating near 9400 Mc/s. The region between initial density level (upon removal of a 24.5 Mc/s ionizing voltage) and 500 μsec later was investigated. Examples of results obtained for commercial neon using this method of measurement are included. In general, it was observed that for commercial neon 97% of the electron density loss occurred within the first 250 μsec after removal of the ionizing voltage. The equipment used along with photographs of the arrangement, and the results obtained are discussed briefly. A.

537.582 : 537.543.2 : 621.385.032.216

497. STUDY OF THE DISTRIBUTION OF THE WORK FUNCTION ALONG THE SURFACE OF AN OXIDE CATHODE. D.G.Bulȳginskiĭ and L.N.Dobretsov.
Zh. tekh. Fiz., Vol. 26, No. 6, 1141-9 (1956). In Russian.

The purpose of the work was to devise a method of measurement of the function $\beta(\varphi)$ for heterogeneous cathodes and, to define this function for a number of states of an oxide cathode; function $\beta(\varphi)$ can be called the distribution of the surface area of the cathode in relation to its work function. It is clear from the graphs that the accuracy of the measured function $\beta(\varphi)$ was not sufficiently high to permit conclusions about details and form of the curve; however, the method gives a general character of the function and such qualitative parameters as the maximum and minimum work functions, their variation with temperature etc. The difference in work functions for various elements appears to be due to the non-uniform concentration of donors in the respective parts on the cathode surface, the local work function increases linearly with temperature, the rate of increase rises with decreasing concentration of donors and this is accompanied by a general broadening of the curve $\beta(\varphi)$. Z.F.Wojnar

537.583

498. REACTIONS OCCURRING DURING DECOMPOSITION OF ALKALINE EARTH CARBONATES ON TUNGSTEN. M.A.Cayless and B.N.Watts.
Brit. J. appl. Phys., Vol. 7, No. 10, 351-4 (Oct., 1956).

Analysis of the gases evolved during decomposition of alkaline earth carbonates on tungsten coiled cathodes shows

that carbon dioxide, carbon monoxide and hydrogen are the principal gases evolved. The ratio of carbon dioxide to carbon monoxide is found to be markedly dependent on the decomposition schedule, varying widely with temperature and speed of exhaust. It is shown that the carbon monoxide is produced during the formation of a basic tungstate interface of the type $(Ba, Sr, Ca)_3\ WO_6$. The chemical reactions involved are discussed and it is shown that none of these reach equilibrium during normal decomposition schedules. The rate of formation of free barium in the completed cathode is determined by the amount of interface produced during breakdown. A.

537.583 : 621.385.032.216

499. IMPREGNATED BARIUM DISPENSER CATHODES CONTAINING STRONTIUM OR CALCIUM OXIDE. I.Brodie and R.O.Jenkins.
J. appl. Phys., Vol. 27, No. 4, 417-18 (April, 1956).

For background see Abstr. 7167/1955. Basic barium silicate 3 $BaO.SiO_2$ was used as impregnant instead of barium aluminate. To reduce the melting point, a half mole of CaO was added to each mole of silicate and an enhanced emission was obtained. Best results were obtained when CaO was added to the aluminate. Life tests on these cathodes at 1200°K and 1.5 A/cm² are still in progress at 5000 hours. A.H.W.Beck

537.583 : 621.385.032.216

500. CURRENT–VOLTAGE CHARACTERISTICS OF THE OXIDE COATED CATHODE AT LOW ACTIVATION ENERGIES. R.E.J.King.
Research Correspondence, Vol. 9, No. 3, S9-S10 (March, 1956).

The non-linearities of the current–voltage characteristics were measured by a harmonic method. At temperatures in the range 300-600°K and for voltages up to 15 V, the maximum deviation from linearity was 10%. Transitional resistances between grains and increased mobility at high fields possibly account for the observations. A.H.W.Beck

537.583 : 621.385.032.213

501. THERMIONIC EMISSION FROM OXIDE-COATED CATHODES AS A FUNCTION OF CORE-METAL IMPURITIES. H.Bender.
Vide, Vol. 11, 112-28 (May-June, 1956). In French.

The effect of the composition of filament and cathode alloys on thermionic emission is reviewed historically, and a comparison of this work is made with that carried out by Sylvania. The reported effect on emission of all additive elements mentioned is tabulated for the case of oxide-coated Ni alloys, and suggestions for future work indicated. Small additions of Al, Mg, Si, Ti, Ba, or Cr to Ni were found to aid d.c. emission. Additions of B, Be, Ce, Fe, or Mn were found to depress emission. Other additive elements are also discussed. A.

537.583

502. APPLICATION OF THE MASS SPECTROMETER FOR THE STUDY OF THE PROCESS OF ACTIVATION OF AN OXIDE CATHODE. N.D.Morgulis and G.Ya.Pikus.
Zh. tekh. Fiz., Vol. 26, No. 6, 1174-6 (1956). In Russian.

The mass spectrometer system used had a sectorial 60° wide magnetic field and a glass tube, the degree of mass resolution was $\Delta m/m \cong 0.01$. First results show that the mass spectrometer method of analysis of the liberation of gas from an oxide cathode gives a number of valuable data.

Z.F.Wojnar

537.585

503. SURFACE IONIZATION OF CALCIUM, STRONTIUM AND MAGNESIUM ON OXIDIZED TUNGSTEN. Yu.K.Szhenov.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 901-2 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 775-6 (July, 1956).

Describes experiments in which certain alkaline earth elements were ionized at hot tungsten surfaces. The increase in this ionization caused by oxidation of the tungsten in a stream of oxygen is briefly discussed. J.D.Craggs

COSMIC RAYS 537.591

537.591

504. THE FRAGMENTATION OF HEAVY NUCLEI OF THE PRIMARY COMPONENT OF COSMIC RAYS AND THE INTERACTION OF THE α-PARTICLES THUS GENERATED. F.Hänni.
Helv. phys. Acta, Vol. 29, No. 3, 281-6 (1956). In German.

This has been examined on a stack exposed in the Sardinia expedition and on another, exposed in Texas. The mean free paths and the fragmentation probabilities have been determined. The α-particle examination allows the determination of the meson yield as a function of energy of the primary particle.

E.W.Kellermann

537.591 : 539.172.11

ALPHA-PARTICLE COLLISIONS IN COSMIC RAYS.
See Abstr. 687

537.591.1

505. ON THE POSITIVE EXCESS AT LOW ENERGIES AND AT SEA LEVEL. G.Poiani and G.Salvatori.
Nuovo Cimento (Ser. 10), Vol. 4, No. 2, 503-4 (Aug., 1956).

This has been measured by means of counter trays and absorbers relying on the competition between decay processes and nuclear capture of mesons in samples of carbon and sulphur. It is estimated that the lowest momentum band measured is $87 \pm {}^{90}_{4}$ MeV/c in which the positive excess is 1.01 ± 0.07 thus seeming to confirm the tendency of the positive excess towards zero at very low energies.

E.W.Kellermann

537.591.15

506. ON A HIGH ENERGY ELECTRONIC SHOWER. L.Barbanti-Silva, C.Bonacini, C.De Pietri, I.Iori, G.Lovera, R.Perilli-Fedeli and A.Roveri.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1465-6 (June, 1956).

This has been observed in a stack of stripped emulsions flown at 93 000 ft during the Texas flights (January, 1955). The distances from the origin of the first pair, and the radial distance from the axis of the shower core, of the starting points of the others have been tabulated for the first 21 pairs. The analysis of the peculiar features of the shower is interesting in view of a possible check of the laws of quantum electrodynamics. E.W.Kellermann

537.591.15

507. ELECTRON PRODUCTION IN SHOWERS OF ENERGIES BETWEEN 10 AND 100 GeV. K.Sitte.
Nuovo Cimento (Ser. 10), Vol. 3, No. 6, 1467-70 (June, 1956).

Cloud-chamber photographs have been examined in order to determine both the number of π^0-mesons emitted, and their total energy as a function of the primary energy. It appears that the inelasticity is practically constant for primary energies between 10 and 100 GeV. E.W.Kellermann

537.591.15

508. THE FORM OF THE ROSSI CURVE WITH LARGE THICKNESSES OF LEAD. L.Jánossy and L.Nagy.
Z. Naturforsch., Vol. 11a, No. 4, 312-15 (April, 1956). In German.

Measurements of the Rossi transition curve were carried out with an arrangement similar to that of Thurn and Bothe. In contrast to the results of these authors no maximum, except the first, was found in the curve. The statistical inaccuracy was of the order of 0.5%. Even if one assumes fluctuations of three times this, the results are irreconcilable with a maximum of more than 1.5%. D.J.A.Prowse

537.591.15

509. THE FORM OF THE SHOWER PRODUCED [ROSSI] CURVE WITH LARGE THICKNESSES OF LEAD. H.Faissner, K.H.Lauterjung and B.Schimmer.
Z. Naturforsch., Vol. 11a, No. 4, 315-22 (April, 1956). In German.

Using a counter arrangement similar to that of Thurn and Bothe, the Rossi curve was measured for a total thickness of 40 cm lead. The apparatus and conditions were varied many times but the only maximum to appear was the first at about 2 cm. The height of the Rossi maximum was essentially smaller than that found by Thurn and Bothe. In a further experiment with an arrangement similar to that used by Schmeiser and Bothe, again no additional maximum was found.

D.J.A.Prowse

537.591.15

510. CASCADE SHOWERS PRODUCED BY ELECTRONS AND PHOTONS IN LIGHT AND HEAVY ELEMENTS. I.P.Ivanenko.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 86-104 (1956). In Russian.

A method of plotting cascade curves from known moments is presented. Cascade curves in light elements for primary electrons and photons with an energy E_0 are computed (E_0 is a quantity of the same order of magnitude as the critical energy for the given substance). A recurrence formula is deduced which permits one to calculate all cascade curve moments, taking into account scattering, ionization losses and the dependence of the total photon absorption coefficient $\sigma(E)$ on energy, for an arbitrary primary particle spectrum. Numerical calculations of the first two moments of the electron distribution curve in lead were carried out for a primary photon spectrum of the form $1/E$. The cascade curves in lead were computed on basis of known moments $\bar{t}$ and $\bar{t}^2$. Results of the calculations are compared with experiment. A.

537.591.5

511. GEOMAGNETIC EFFECT OF BROAD SHOWERS OF COSMIC RAYS. J.Dubinský, P.Chaloupka, V.Petržílka and L.Tomášková.
Czech. J. Phys., Vol. 6, No. 1, 29-34 (Jan., 1956). In Russian, with summary (1 p.) in English.

The paper describes an investigation into the effect of the terrestrial magnetic field upon the density distribution of extensive showers of cosmic rays. A unit consisting of two pairs of G.-M. counters separated by a 20 cm thick Pb absorber was used to define the core of the shower. A second similar unit of four G.-M. counters in parallel was set up successively south and west of the first unit for equal times and at equal distances. Measurements showed that for 30 m separation of counter units the density to the west is 40% greater than to the south; at 50 m separation this difference increased to 60%. These differences far exceed the limits of statistical error.

C.R.S.Manders

537.591.5

512. A LARGE OUTBURST OF COSMIC RAY INTENSITY ON 23 FEBRUARY 1956 OBSERVED IN MOSCOW, SVERDLOVSK, TBILISI AND CAPE SCHMIDT. L.I.Dorman, N.S.Kaminer, V.K.Konava and B.F.Shvartsman.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 809-12 (1956). In Russian.

Detailed measurements of intensity against time for this outburst, which was apparently about ten times larger than the last one in 1949, are given. In the Moscow-Sverdlovsk region the hard component increased 400-500% at the maximum of the outburst. G.E.Brown

537.591.5 : 523.745

513. COSMIC-RAY OBSERVATIONS DURING THE FLARE OF 23 FEBRUARY 1956. T.E.Cranshaw, W.Galbraith and N.A.Porter.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 274-6 (May, 1956).

Following the onset of the solar c.r. disturbance at 0345 U.T., rapid development of the pulse occurred, with an increase in the coincidence-counting rate of 70% in less than 1 min. The rate then rose more slowly to a max. of about 220% 9 min from the start. A decrease to half the max. rate occupied a further 15 min period. D.R.Barber

537.591.5

514. COSMIC RAYS AND THE SOLAR FLARE OF 23 FEBRUARY 1956. M.Lambie and H.Elliot.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 277-8 (May, 1956).

In London, a wide-acceptance G.M.counter array of five independent sets, recording twofold-coincidence pulses under concrete roof shielding (40 $g.cm^{-2}$) gave a peak flux of additional protons, 0.015 per cm^2 per sec, compared with a flux of 0.039 per cm^2 per sec (neutrons + protons) at Leeds, over the same time interval. On correcting the latter value for neutron component, the proton flux is 0.016 per cm^2 per sec, in good agreement with the London data. Thus the flux of additional particles must have been very similar at the two places, in spite of the great difference in percentage increases observed at Leeds (about 450), and London (about 120) respectively. D.R.Barber

537.591.5

515. VARIATION OF COSMIC-RAY NUCLEON INTENSITY DURING THE DISTURBANCE OF 23 FEBRUARY, 1956. P.L.Marsden, J.W.Berry, P.Fieldhouse and J.G.Wilson.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 278-81 (May, 1956).

Using a cosmic-ray nucleonic component recorder, insensitive to nucleons of energy less than about 10 MeV, the estimated peak counting-rate was between 1.26×10^4 and 1.31×10^4 min^{-1} during the period, 0345 to 0400 U.T. i.e. about six times normal. D.R.Barber

537.591.5

516. OBSERVATION OF THE LARGE COSMIC RAY INCREASE OF FEBRUARY 23, 1956 IN THE U.S.S.R. L.I.Dorman, N.S.Kaminer, V.K.Koiava, Yu. G.Shafer and B.F.Schwarzman.
Nuclear Physics, Vol. 1, No. 8, 585-92 (July, 1956).

Details of the large cosmic-ray increase of February 23rd at the following stations are reported: Moscow, Sverdlovsk, Tbilisi, Yakutsk and Cape Schmidt. No connection was established between the intensity increase and chromosphere eruptions of the sun; a large ionosphere perturbation was observed on the side of the earth which faced the sun at the beginning of the disturbance. The increase was almost simultaneous from Moscow to Yakutsk; this is unusual as there is usually an appreciable time-delay between disturbances occurring great distances apart. It appears that this increase was about 5-10 times as intense as that occurring in 1949 and was probably caused by particles of energies up to 10 BeV.

D.J.A.Prowse

537.591.5

517. A NEW OUTBURST OF SOLAR COSMIC RAYS. A.Ehmert and G.Pfotzer.
Z. Naturforsch., Vol. 11a, No. 4, 322-4 (April, 1956). In German.

The detection and examination of the large cosmic ray intensity increase of February 23rd at Weissenau (Germany) is reported. It was the most intense ever recorded and it is compared with the other large increases observed in 1942, 1946 and 1949. Three different coincidence arrangements were used to measure the charged particles, the neutrons being monitored by a fourth arrangement. D.J.A.Prowse

537.591.5

518. THE ANOMALOUS INCREASE OF THE COSMIC RADIATION ON FEBRUARY 23RD, 1956. A.Sittkus.
Z. Naturforsch., Vol. 11a, No. 7, 604-6 (July, 1956). In German.

The time of onset of this as well as its initial course is different in Freiburg and Schauinsland and at other stations, compared with Chicago. It is concluded that the particles causing the increase at Chicago have not arrived straight from the sun, but that they have been emitted in other directions first, and arrive at the earth after magnetic deviations and scattering. The implications of this are discussed.

E.W.Kellermann

537.591.5

519. MODULATION OF PRIMARY COSMIC-RAY INTENSITY. E.N.Parker.
Phys. Rev., Vol. 103, No. 5, 1518-33 (Sept. 1, 1956).

It is assumed that the cosmic-ray particles observed at the earth are of galactic origin, except for the occasional bursts from solar flares. With this interpretation the 11-year variation of the cosmic-ray intensity and the Forbush decreases represent depressions of the steady galactic intensity. The observed rigidity dependence of the depression indicates that magnetic fields are responsible. A quantitative investigation of the possible motion and configuration of magnetic fields capable of producing the observed effects is carried out. It is shown that, within the limitations imposed by what we know today of the galactic magnetic field, of solar activity, and of interplanetary fields, serious difficulties are encountered by any mechanism, such as Morrison's interplanetary cloud model, modulating the galactic cosmic-ray intensity throughout the solar system. It is proposed that the modulation of the intensity is produced locally, within a few earth's radii, by interplanetary magnetic gas clouds captured by the terrestrial gravitational field. Such a model seems to produce the observed effects on the basis of the known facts about solar activity. The most straightforward test of this geocentric model, independent of inferences from cosmic-ray effects, is the question of whether the absorption of the captured magnetic hydrogen gas can be detected as a narrow line in the centre of the broad solar L_α emission line. A.

537.591.5

520. TIME VARIATION OF PRIMARY HEAVY NUCLEI IN COSMIC RADIATION. M.Koshiba and M.Schein.
Phys. Rev., Vol. 103, No. 6, 1820-4 (Sept. 15, 1956).

The time variation of heavy nuclei in the primary cosmic

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radiation was investigated by using the method of a moving-plate mechanism which was flown to an altitude of 100 000 feet by a Skyhook balloon. The results obtained clearly indicate a time variation of primary heavy nuclei $Z > \sim 10$. The variation is characterized its maximum at around 9 : 00 a.m., having an amplitude of $34 \pm 7\%$ at the maximum. Comparisons are made with other experimental data on the same subject and also with the neutron intensity variation on the same day at Climax, Colorado. Possible consequences of this rather large fluctuation of the primary heavy nuclei are discussed. A.

537.591.5 : 523.72

521. COSMIC-RAYS AND CORPUSCLES FROM THE SUN. Y.Sekido.
Rep. Ionosphere Res. Japan, Vol. 9, No. 3, 181-2 (1955).

An examination has been made of any unusual increases of cosmic rays, anomalous diurnal variations during cosmic-rays storms, and the correlation between cosmic-ray decreases, geomagnetic disturbances, and solar phenomena at a number of stations. Various interpretations of the phenomena are suggested. G.M.Brown

537.591.5

522. ON THE CORRELATION BETWEEN THE INTENSITY OF DIFFERENT COMPONENTS OF COSMIC RAYS, THE METEOROLOGICAL CONDITIONS AND MAGNETIC STORMS. B.Trumpy.
Univ. Bergen Arbok, 1954, Paper 2, 19 pp.

Coefficients for variation of the hard and soft cosmic ray components with (a) barometric pressure (b) height of 100 mb level and (c) temperature just below 100 mb level were obtained. Equipment was used capable of giving $\cong 1\%$ standard deviations on a two-hour run. Correlations were made with radio-sonde measurements. Evidence is produced which indicates that the soft component at sea level is not entirely produced by the meson component. Magnetic storm effects were also studied. Detailed results are given in tabular form for the period March 1952 to April 1954. A slight correlation appears to exist. The soft component variation is greater, and during magnetic storms a diurnal variation of the soft component was detected. Theoretical models are discussed. R.H.W.Johnston

537.591.8

523. ON THE ANELASTICITY OF COSMIC RAY JETS. A.Wataghin.
Nuovo Cimento (Ser. 10), Vol. 4, No. 1, 154-5 (July, 1956).

An analysis has been made of 35 jets found in nuclear emulsions exposed at altitudes of about 30 km. Their energies are in the interval from 6 GeV to 600 GeV. The average inelasticity $\bar{K}$ is 0.65 ± 0.5. A tendency is noted for K to decrease with increasing energy. It seems that these results are intermediate between data belonging to energy ranges below and above the interval here. E.W.Kellermann

537.591.8

524. INTERACTIONS OF VERY HIGH ENERGY IN THE COSMIC RADIATION. E.Lohrmann.
Z. Naturforsch., Vol. 11a, No. 7, 561-79 (July, 1956). In German.

The measurement of multiple scattering at high energies is discussed. From the measurement on one electron cascade it is concluded that there is no deviation from the plateau value of the ionization curve up to energies of at least $2 \times 10^6\ mc^2$. An event of the type 5 + 30p is described which was found in a stack exposed in Texas in 1955 at 29 km altitude. The total energy is estimated to be at least 1100 BeV with a mean energy of the mesons in the c.o.m. system of not more than 1.7 BeV. From three photons and their subsequent cascades contained in the soft cascade a mean free path for direct pair production is estimated as 50^{+50}_{-23} mm emulsion. A secondary star of type 3 + 55n was found 26 mm from the first interaction. It is concluded that the mean energy and the energy distribution of the mesons is compatible with Heisenberg's, but incompatible with Fermi's theory. The star of type 2 + 12p is described in which an antiproton is generated (see Abstr. 4637/1956). E.W.Kellermann

MAGNETISM 538

538.082.74

525. A RAPID METHOD FOR MEASURING COERCIVE FORCE AND OTHER FERROMAGNETIC PROPERTIES OF VERY SMALL SAMPLES. G.W.van Oosterhout.
Appl. sci. Res. B, Vol. 6, No. 1-2, 101-4 (1956).

A description is given of a method for the quantitative investigation of the permanent magnetic properties, especially the coercive force, of samples of about one milligram. The method is based essentially on the measurement of the alternating e.m.f., generated by letting the sample vibrate in a searchcoil, with a sensitive voltmeter. For the measurement of magnetic moments the instrument has to be calibrated. It is pointed out how this can be done. The time needed for a measurement is about two minutes. A.

538.113

526. THE MAGNETIC SUSCEPTIBILITY OF THE ALKALI METALS. J.Appel.
Z. Naturforsch., Vol. 11a, No. 7, 613-15 (July, 1956). In German.

Gives reasons for the deviations of the "observed" electronic diamagnetic susceptibilities from the free electron values. E.P.Wohlfarth

538.114

527. TEMPERATURE DEPENDENCE OF ANISOTROPY ENERGY OF FERROMAGNETICS. T.Kasuya.
J. Phys. Soc. Japan, Vol. 11, No. 9, 944-7 (Sept., 1956).

The temperature dependence of anisotropy energy of ferromagnetics was calculated by the spin-wave method which assumes the existence of only pseudodipole interaction in which some restricted long-range forces are included. The temperature dependence obtained is $(M/M_0)^{10}$, a result which is in fairly satisfactory agreement with the experimental $(M/M_0)^{20}$ law, and is an improvement on Van Vleck's result $(M/M_0)^3$. This small discrepancy is discussed from the standpoint of s-d interaction. A.

538.122 : 523.03

528. TWISTED MAGNETIC FIELDS. P.H.Roberts.
Astrophys. J., Vol. 124, No. 2, 430-42 (Sept., 1956).

A study is made of the stability of a twisted tube of magnetic force lying within an infinitely conducting fluid. It is shown that the system is unstable. A.

538.22

529. STUDIES ON THE MAGNETIC SUSCEPTIBILITY OF THE Cr^{+3} ALUMS IN THE RANGE 300°K TO 100°K. S.K.Dutta Roy.
Indian J. Phys., Vol. 30, No. 4, 169-88 (April, 1956).

The results of some accurate measurements of the magnetic susceptibility of a series of Cr^{+3} double sulphate, sulphato-selenate and selenate alums in the range 300°K to 100°K are discussed. Analysis of the mean square moments shows the existence of an appreciable contribution from Van Vleck's high frequency paramagnetism and an orbital contribution to the Curie term comparable to the high-frequency term, over and above the spin contribution. The Weiss term due to spin separation by the anisotropic crystalline field, is, however, negligibly small in the Cr^{+3} alums in the temperature range considered. In most of the alums an appreciable temperature-dependence of the h.f. and Curie term is observed, stimulating the effect of a Weiss term. This temperature dependence is reversible and may be better represented by two sets of h.f. and Curie coefficients, one for the upper and the other for the lower range of temperature, and evidently arises from the thermal expansion of the alum lattice, and very probably also from the variation with temperature in the proportion of the two coexisting phases of the α, β and γ alums or the thermal conversion from one phase to another, and the consequent changes in the crystalline electric field acting on the Cr^{+3} ion. Taking the spin orbit coupling to be not very different from the free ion value of $+ 87\ cm^{-1}$, optical absorption and paramagnetic resonance results have been compared with the magnetic susceptibility data and an estimate of the covalency factor and cubic separation of the orbital levels made. A.

538.221 : 538.652

530. THE DYNAMIC MAGNETOSTRICTION OF NICKEL–COBALT ALLOYS. C.A.Clark.
Brit. J. appl. Phys., Vol. 7, No. 10, 355-60 (Oct., 1956).

The magnetostrictive properties of binary nickel–cobalt alloys in the range 0-23% cobalt are discussed, with particular reference to the use of these materials for transducers. Measurements, at various polarizing fields, of the electromechanical coupling coefficient, reversible permeability and Young's modulus are described. Various criteria which govern the choice of magnetic materials for ultrasonic transducers are discussed and it is shown that two alloys, containing respectively about 4.4 and 18.4% cobalt, give good performance as transducer materials. A.

538.221 : 538.614

531. POLARIMETRIC STUDY OF A FERRITE IN THE 2000 Mc/s BAND. P.Loudette and A.Charru.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 251-4 (July 16, 1956). In French.

The rotation of the plane of polarization and the ellipticity of a TE_{11} wave in a circular waveguide, produced by a nickel–zinc ferrite rod, are measured as a function of wavelength and applied longitudinal magnetic field. A correspondence is observed between the effects produced by the variation of these two parameters. J.B.Birks

538.221 : 621.318.2

532. HEAT CHANGES ACCOMPANYING MAGNETIZATION PROCESSES IN FERRITES. L.F.Bates and D.A.Christoffel.
Proc. Instn Elect. Engrs, Paper 2212 R, publ. Oct., 1956, 7 pp. To be republished in Vol. 104 B (1957).

A brief survey is given of the method of measurement of the small thermal changes which accompany changes in magnetization, together with an outline of the procedure for the discussion of experimental data based on current theories of ferromagnetic processes. New measurements are described on a series of ferrites which include nickel–zinc, manganese–zinc, magnesium–zinc and lithium–chromium specimens. Evidence is presented that domain boundary movements occur in low fields; in high fields rotation of domain vectors are paramount. The manganese–zinc ferrite shows a peak in the thermal changes in low fields, whereas with all the other specimens at room temperature a "dip" is observed. The magneto-thermal behaviour of lithium–chromium ferrite is in accord with its unusual magnetic properties. A.

538.221

533. THE TEMPERATURE-DEPENDENT RESISTIVITY OF CERTAIN IRON DEFICIENT MAGNESIUM MANGANESE FERRITES. W.P.Osmond.
J. Electronics, Vol. 1, No. 6, 665-6 (May, 1956).

Suggests that the dependence of resistivity on firing temperature (Abstr. 6779/1956) can be accounted for by incomplete oxidation. W.Bardsley

538.221

534. FERRIMAGNETISM OF Mn_4N. R.Juza and H.Puff.
Naturwissenschaften, Vol. 43, No. 10, 225 (1956). In German.

Reports results of measurements of the saturation magnetization of Mn_4N with reduced N content, N replaced by C or Mn replaced by Cu. The p_B values vary linearly with composition and the results are discussed quantitatively. E.P.Wohlfarth

538.221

535. MAGNETIC AFTER-EFFECT PHENOMENA. W.Holzmüller.
Nachrichtentechnik, Vol. 6, No. 7, 306-12 (July, 1956). In German.

An account of resonance and relaxation effects, and of after-effect phenomena in magnetic materials. The temperature dependence of the various types of after-effect are described and the physical mechanisms responsible for these are described. Mechanical resonances of inclusions and holes, excited by the movement of domain walls, are investigated, and the damping of these oscillations by the emission of heat waves is calculated. It is also shown that although rotational processes are responsible for most of the changes of magnetization in ferrites, domain wall displacements can contribute to the hysteresis loss. A.E.De Barr

538.221

536. THE MAGNETIC PROPERTIES OF MnAs AND MnBi. A.J.Manuel.
Proc. Phys. Soc. B., Vol. 69, Pt 6, 691-2 (June, 1956).

Observed transitions from ferromagnetic to antiferromagnetic characteristics with temperature are explained by suggesting that at low temperatures the substances are ferromagnetically ordered in 3 dimensions but on raising the temperature a weaker interaction between the basal planes is broken up leaving an assembly of 2 dimensional ferromagnetically ordered triangular networks of the basal planes. G.F.Hodsman

538.221

537. A NEW METHOD OF MEASUREMENT OF THE MAGNETIC PROPERTIES OF THIN FILMS BY MEANS OF THE FARADAY EFFECT. L.Reimer.
Z. Naturforsch., Vol. 11a, No. 7, 611 (July, 1956). In German.

The rotation, φ, of the plane of polarization was measured as a function of field strength H for a Ni film of thickness 450 A evaporated on glass. To avoid large demagnetizing effects H was applied parallel to the film surface and the incident light at 45° to the normal. The (φ, H) curve is a hysteresis loop with coercive force about 30 oersted. E.P.Wohlfarth

538.221

538. ANTIFERROMAGNETISM OF ANHYDROUS SULPHATES OF Ni^{++}, Fe^{++}, Co^{++}, Cu^{++}. A.S.Borovik-Romanov, V.R.Karasik and N.M.Kreĭnes.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 18-24 (1956). In Russian.

The temperature dependence of the magnetic susceptibility of four anhydrous sulphates: $NiSO_4$, $FeSO_4$, $CoSO_4$ and $CuSO_4$ was investigated in the temperature range from 12° K to 300° K. Susceptibility peaks characteristic of the antiferromagnetic transition were detected. It is suggested that in $CuSO_4$ at 35° K half of the Cu^{++} ions have antiferromagnetic ordering. It is shown that below the Curie point the magnetic susceptibility of $NiSO_4$ decreases with temperature according to a quadratic law. A.

538.221

539. THE PERMEABILITY OF COPPER FERRITE IN H.F. ALTERNATING FIELDS; PECULIARITIES IN THE REGION OF THE CURIE POINT. K.Stierstadt.
Z. Phys., Vol. 146, No. 2, 169-86 (1956). In German.

Reports results of measurements of the complex permeability between 15 and 60 Mc/s. At low temperatures the reversible permeability is determined by a wall motion and near the Curie point by rotational processes. The ferrite $Fe_2.CuFe_2.O_8$, obtained by sintering above 950° C, has (μ, T) curves of quite different shape from those of the ferrite $Fe.CuFe.O_4$, obtained by sintering below 950° C. The latter substance undergoes a crystallographic transformation at 360° C which was investigated. The application of magnetic fields up to 340 Oe increases the permeability near the Curie point due to an increase in the true magnetization. E.P.Wohlfarth

538.221 : 539.152.2

POLARIZATION OF THE NUCLEI OF FERROMAGNETIC ATOMS. See Abstr. 625

538.242

540. THE SATURATION MAGNETIZATION OF NICKEL UNDER HIGH HYDROSTATIC PRESSURE. K.H.v.Klitzing and J.Gielessen.
Z. Phys., Vol. 146, No. 1, 59-64 (1956). In German.

The pressure coefficient of the magnetization of nickel under hydrostatic pressures up to 5.3×10^3 atm and a field of strength 6.4×10^3 oersted was found to be less than 1.2×10^{-7} atm^{-1}, i.e. much less than the value 1.1×10^{-5} atm^{-1} obtained by Jones and Stacey (Abstr. 4237/1953). The pressures used by the latter are believed to be not purely hydrostatic. E.P.Wohlfarth

538.245

541. A NOTE ON L.VALENTA'S PAPER: THE SPONTANEOUS MAGNETIZATION OF A LINEAR MODEL OF A FERROMAGNETIC TOROID IN A MAGNETIC FIELD. L.Hrivnák.
Czech. J. Phys., Vol. 6, No. 2, 195-6 (April, 1956).

See Abstr. 9762 (1956). The use of a different approximation leads to an expression for the saturation magnetization which gives the expected value. A.E.De Barr

538.245

542. THE INFLUENCE OF TENSION ON THE STRUCTURE OF BITTER–AKULOV PATTERNS. P.Šuda.
Czech. J. Phys., Vol. 6, No. 3, 300-2 (June, 1956).

If electrolytic polishing of a mechanically polished ferromagnetic material is of short duration, so that the deformed surface layers are not completely removed, colloidal magnetic particles on the surface form labyrinths the shape and size of which depend on the crystallographic orientation of the surfaces and the mechanical condition of the material. Such patterns have been studied on a sample of transformer sheet (4% silicon) under tension. As the tension increased the labyrinth pattern gave way to a dagger-like pattern which could be identified as domain structure. On removing the tension a pattern similar to the original is restored in spite of a 1% length increase. The observed phenomena can be explained by assuming the internal stresses are compensated by the applied tension thus eliminating their influence on the magnetic structure. F.E.Hoare

538.245

543. A FERROMAGNETIC SPHERE IN A STRONG MAGNETIC FIELD. B.M.Fradkin.
Zh. tekh. Fiz., Vol. 26, No. 5, 1048-59 (1956). In Russian.

It is assumed that the hysteresis loop is, with a sufficient degree of accuracy, represented by a rectangular graph. The process of inverting the direction of the field is studied, in particular the propagation of a wave of demagnetization. The magnetic effect of eddy currents is taken into account. The mean magnetic moment of the sphere is obtained in terms of the external field strength and the magnetic properties of the material. R.Eisenschitz

ELECTROMAGNETISM. ELECTROMAGNETIC WAVES 538.3/.5

538.3

544. A SIMPLE DERIVATION OF THE EQUATIONS OF MOTION IN CLASSICAL ELECTRODYNAMICS. L.Infeld and J.Plebański.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 4, No. 6, 347-51 (1956).

The derivation follows that recently proposed by Infeld (Abstr. 7678/1955) for the equations of motion in general linear field theory. Although, in a sense, a compromise between the previous derivations of Dirac (Proc. Roy. Soc. A, Vol. 167, 148, 1938) and of Infeld and Wallace (Phys. Rev., Vol. 57, 797, 1940), it is more direct, and hence more amenable to computation, than either. An important feature is the introduction of a spherically symmetric model of Dirac's δ-function for handling singularities in the action integral. J.W.Gardner

538.3

545. NOTE ON A SURPRISING RESULT IN FIELD MECHANICS. F.Bopp.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 3, 469-73 (1956).

Continuing his previous work on modified field equations of the Maxwell type (Abstr. 2876/1946), the author shows how they may give rise to radiationless orbits. P.M.Davidson

538.3

546. ON THE VELOCITY OF ELECTROMAGNETIC ENERGY IN MOVING CRYSTALS. A.M.Manarini.
R.C. Accad. Naz. Lincei, Vol. 20, No. 3, 357-62 (March, 1956). In Italian.

Detailed calculation shows that, for motion parallel to a principal axis of a crystalline medium, the relativistic law of composition of velocities is satisfied by the energy associated with a plane wave. R.A.Newing

538.3

547. ON THE DETERMINATION OF THE ELECTROMAGNETIC FIELD IN THE INTERIOR OF A HOMOGENEOUS ISOTROPIC CONDUCTOR. I. A.Tonolo.
R.C. Accad. Naz. Lincei, Vol. 20, No. 4, 403-8 (April, 1956). In Italian.

Analytical expressions are obtained for the field intensities within a conducting medium in terms of their initial values throughout the medium and their values at any time on the bounding surface. R.A.Newing

538.56 : 532.51

548. ON THE STABILITY OF THE SIMPLEST SOLUTION OF THE EQUATIONS OF HYDROMAGNETICS. S.Chandrasekhar.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 5, 273-6 (May, 1956).

It is noted that an exact stationary solution is given by $v_i = \pm\vec{H}_i(\mu/4\pi\rho)^{1/2}$, $p + \rho V + \mu|\vec{H}|^2/8\pi = \text{const.}$, where v_i, p, ρ and V are the velocity components, pressure, density and gravitational potential in an incompressible fluid of infinite conductivity and $\vec{H}$ is the magnetic intensity. The motion is shown to be stable, and an expression obtained for the period of small oscillations is in a form suitable for variational calculations. R.A.Newing

538.56 : 532.5

549. ON SOME SECOND-ORDER EFFECTS IN MAGNETOHYDRODYNAMICS. I. R.Nardini.
R.C. Accad. Naz. Lincei, Vol. 20, No. 4, 457-62 (April, 1956). In Italian.

In a preliminary investigation of the interaction of acoustic and magnetohydrodynamic phenomena, it is shown that, to a first approximation, the motion may be represented in terms of two independent waves: a transverse magnetohydrodynamic wave and a longitudinal sound wave. The investigation is concerned with plane waves in a slightly compressible medium in the presence of a uniform magnetic field normal to the wave front. R.A.Newing

538.561 : 621.372.413

550. APPLICATION OF THE METHOD OF CURVILINEAR COORDINATES FOR DESIGN OF A Π-SHAPED RESONATOR. V.L.Patrushev.
Zh. tekh. Fiz., Vol. 26, No. 4, 821-31 (1956). In Russian.

A cylindrical resonator of finite length, closed at one end, contains a concentric cylindrical rod at a finite distance from the closed end. Conformal representation is used to obtain the resulting equipotentials, lines of force, e.m. field components and Q factor. The formulae are applied to a practical resonator, in which close agreement is obtained between theoretical and measured natural frequency. M.W.Makowski

538.566

551. THE FIELD OF AN ALTERNATING DIPOLE IN A NON-HOMOGENEOUS SEMI-INFINITE MEDIUM. O.Praus.
Czech. J. Phys., Vol. 5, No. 4, 515-27 (Dec., 1955). In Russian, with summary (200 words) in English.

This has been studied theoretically for the case of a low-frequency dipole at the earth's surface, which is taken to be non-homogeneous and semi-infinite with a discontinuity in its conductivity at a given depth. A general solution is derived. From the direct component resistance curves are obtained which can be used in the interpretation of field measurements. The alternating component is used to calculate curves of the mutual impedances of two dipoles. These curves may be useful in determining the depth of the boundary between two layers of different conductivities. J.B.Arthur

538.566 : 621.372.2

552. ELECTROMAGNETIC PROCESSES IN A MULTICONDUCTOR SYSTEM. P.I.Kuznetsov and R.L.Stratonovich.
Izv. Akad. Nauk SSSR, Otdel tekh. Nauk, 1954, No. 9, 3-23. In Russian.

The transmission-line equations for a system of thin, parallel imperfectly conducting cylindrical wires are deduced. Only those modes are considered which in the limit of perfect conductivity become transverse electromagnetic. The method is applied to the case of a parallel wire over a perfectly conducting ground. The two modes of propagation of such a line are investigated in detail. Mathematical Reviews

538.566 : 550.341

553. SOLUTION OF AN INTEGRAL EQUATION OCCURRING IN IMPULSIVE WAVE PROPAGATION PROBLEMS. C.L.Pekeris.
Proc. Nat. Acad. Sci. U.S.A., Vol. 42, No. 7, 439-43 (July, 1956).

An integral equation that commonly occurs in considering the propagation of seismic or electromagnetic waves, usually in media having doubly or multiply refracting properties, is $p\int_0^\infty e^{-pt}W(t, r, H)dt = \frac{p}{c}\int_0^\infty J_0(\frac{p}{c}rx)\,f(x)\,\exp[-(p/c)H\sqrt{(x^2+a^2)}]x\,dx$. This equation presents certain mathematical difficulties but a

general method of solution has been derived by the author. An abbreviated version of the solution of the problem of the seismic buried source in a doubly refracting medium is given to illustrate the application of the method to related propagation problems. In some applications, it is necessary to invert the integral equation

$$p\int_0^\infty e^{-pt}S(t, r, H)dt = \frac{p}{c}\int_0^\infty J_1(\frac{p}{c}rx)x^2g(x)\exp[-(p/c)H\sqrt{(x^2+a^2)}]dx,$$

where $g(x) = R_3[x^2, \sqrt{(x^2+a^2)}, \sqrt{(x^2+\lambda^2)}]$. The solution of this equation is also given. H.J.H Starks

538.566

554. GENERAL SOLUTIONS FOR THE DIFFRACTION OF A DIPOLE FIELD BY A PERFECTLY CONDUCTING WEDGE. R.Teisseyre.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 3, No. 10, 523-6 (1955).

The solutions are derived by a modification of the method previously used by Senior (Abstr. 7801/1953). Only the main results are given. The method is to be more fully discussed in a later paper. G.D.Sims

538.566

555. THE DIFFRACTION OF A CYLINDRICAL PULSE BY A HALF-PLANE. R.D.Turner.
Quart. appl. Math., Vol. 14, No. 1, 63-73 (April, 1956).

A solution is obtained when the wave-function is constrained to vanish over the half-plane, the excitation being a line source parallel to the edge. The method, which may be extended to the case of a wedge and to the diffusion equation, is based on the derivation of Green's function for the time-dependent wave equation and involves two integral transformations and inversions. The solution is expressed in terms of a slowly convergent series, which would however converge more rapidly for a less singular excitation and which may be summed in certain special cases. R.A.Newing

538.566

556. INTEGRO-DIFFERENTIAL EQUATIONS AND BABINET'S PRINCIPLE FOR PLANE SCREENS WITH UNIDIRECTIONAL CONDUCTIVITY. G.Toraldo di Francia.
R.C. Accad. Naz. Lincei, Vol. 20, No. 4, 476-80 (April, 1956). In Italian.

538.566 : 621.318.1 : 621.372.8

557. WAVEGUIDE COMPONENTS WITH NON-RECIPROCAL PROPERTIES. I. FERROMAGNETIC RESONANCE AND FARADAY ROTATION. J.Brown and P.J.B.Clarricoats.
Electronic Engng, Vol. 28, 328-32 (Aug., 1956).

When an electromagnetic wave travels through a magnetized magnetic material, the polarization rotates. The physical mechanism causing this Faraday rotation and a related effect, ferromagnetic resonance, is explained with particular reference to ferrites and to their use in waveguide components. A.E. DeBarr

538.566 : 621.372.8

558. PROPAGATION COEFFICIENT IN A WAVEGUIDE OF FINITE CONDUCTIVITY. A.E.Karbowiak.
J. appl. Phys., Vol. 27, No. 4, 421-2 (April, 1956).

From consideration of surface impedance a formula is derived giving the propagation coefficient in a lossy rectangular waveguide at frequencies below, above and at cut-off. The analysis could be extended to any other form of waveguide. W.T.Blackband

538.566

559. THEORY OF WAVE PROPAGATION IN A GYROMAGNETIC MEDIUM. P.S.Epstein.
Rev. mod. Phys., Vol. 28, No. 1, 3-17 (Jan., 1956).

Consideration of propagation in a gyromagnetic medium leads to a fourth-order partial differential equation for the electromagnetic field. The characteristics of the general solutions of this equation are considered as well as the properties of the better known TEM solutions. A number of boundary-value problems are discussed including the cases of ferrite-lined and ferrite-filled rectangular waveguides with transverse magnetic field, reflection from a ferrite filling in a rectangular guide, the circular filled guide with longitudinal magnetization, a coaxial filled guide with longitudinal magnetization and the circular guide with a coaxial ferrite core. G.D.Sims

538.566 : 621.396.67 : 621.372.413

560. ON THE THEORY OF THIN AERIALS IN CAVITY RESONATORS. A.V.Gaponov.
Zh. tekh. Fiz., Vol. 25, No. 6, 1069-84 (1955). In Russian.

The problem of free vibrations of a slotted cavity resonator containing thin aerials is formulated as a problem of free vibrations of a conventional cavity resonator with perturbations in the bounding surface. Formulae are developed for the eigenfunctions and for the Q of the resonator. They are applied to the study of various cases of excitation of a cavity resonator by thin aerials. Mathematical Reviews

538.566 : 621.396.67 : 621.372.413

561. EXCITATION OF A CAVITY RESONATOR BY THIN AERIALS. A.V.Gaponov.
Zh. tekh. Fiz., Vol. 25, No. 6, 1085-99 (1955). In Russian.

A continuation of the previous paper (see preceding abstract). A forcing term is added to the basic equation. A perturbation method is used to solve the new equation for cases of excitation by tuned or untuned aerials by external fields or currents. Mathematical Reviews

538.566.2 : 621.318.12 : 621.372.852.22

562. A SURVEY OF THE THEORY AND APPLICATIONS OF FERRITES AT MICROWAVE FREQUENCIES.
P.J.B.Clarricoats, A.G.Hayes and A.F.Harvey.
Proc. Instn Elect. Engrs, Paper 2229 R, publ. Oct., 1956, 16 pp. To be republished in Vol. 104 B (1957).

A brief review of gyromagnetic media in general is followed by a more detailed description of the microwave behaviour of a ferromagnetic medium, of which ferrites form a suitable class of material. The general physical properties of ferrites are outlined briefly, together with a description of several of the mechanisms to account for the dispersion which occurs in their r.f. permeability. The propagation of an electromagnetic wave through an infinite ferrite medium is considered. The properties of different guided systems containing ferrites are then studied. The behaviour of various ferrite waveguide structures is described and their applications are suggested. Most of the data quoted are from published papers, but in a few instances some unpublished work of the authors has been included for completeness. An extensive bibliography completes the survey. A.

MOLECULAR AND ATOMIC STRUCTURE THEORY OF SOLID STATE 539.1

539.11

563. ON THE THEORY OF THE NOBLE METALS.
K.Ladányi.
Acta phys. Hungar., Vol. 5, No. 4, 361-80 (1956). In German.

The statistical theory of Gombás (Die statistische Theorie des Atoms und ihre Anwendungen. Vienna: Springer 1949), is used to calculate the cohesive energy of the noble metals. The "modified" potential of the ion cores is determined semi-empirically by a generalization of Hellmann's method (Acta Physicochimica U.R.S.S., Vol. 1, 913, 1935; Vol. 5, 23, 1936). The results are in satisfactory agreement with experiment. E.H.Sondheimer

539.11 : 539.132

564. TWO-CENTRE INTEGRALS OVER THE ATOMIC SPHERE. M.Suffczyński.
Bull. Acad. Polon. Sci. Cl. 3, Vol. 4, No. 5, 273-7 (1956).

Presents long exact polynomial formulae for that part of the two-centre one-electron Coulomb integral (between 3d Slater atomic orbitals with different exponents) that can be expressed as an integral over the spherical cell round one atom. J.Hawgood

539.11 : 538.222

565. PARAMAGNETIC RELAXATION IN METALS.
S.V.Vonsovskiĭ and S.G.Salikov.
Dokl. Akad. Nauk SSSR, Vol. 96, No. 4, 717-19 (1954). In Russian. English translation in: Atomic Energy Res. Establ. (Harwell) Transl., No. 643, 2 pp. (1956).

Measurements of the paramagnetic absorption of the energy of a high-frequency field by various metal powders are reported. For Cr, V, Sb, Os, Ir, Al, and Zn, the absorption falls sharply with increase of the field strength; W, Cu, Mn, As, Mo, Bi, Te and Sn behave like the above-mentioned metals

at lower frequencies (1.5×10^7 c/s) but at 5.5×10^8 c/s, after a sharp drop to a minimum at 2100 Oe, the absorption rises to a maximum at about 6000 Oe. Rh and Ru show no absorption at zero field, and a maximum at about 6000 Oe at high frequency. The effects are attributed to at least two times of relaxation, one of which is about 10^{-8} sec for most of the metals investigated, and the other is about 10^{-9} sec.

R.C.Murray

539.11

566. ENERGY OF COHESION, COMPRESSIBILITY, AND THE POTENTIAL ENERGY FUNCTIONS OF THE GRAPHITE SYSTEM. L.A.Girifalco and R.A.Lad.
J. chem. Phys., Vol. 25, No. 4, 693-7 (Oct., 1956).

The lattice summations of the potential energy of importance in the graphite system have been computed by direct summation assuming a Lennard-Jones 6-12 potential between carbon atoms. From these summations, potential-energy curves were constructed for interactions between a carbon atom and a graphite monolayer, between a carbon atom and a graphite surface, between a graphite monolayer and a semi-infinite graphite crystal and between two graphite semi-infinite crystals. Using these curves, the equilibrium distance between two isolated physically interacting carbon atoms was found to be 2.70 a, where a is the carbon–carbon distance in a graphite sheet. The distance between a surface plane and the rest of the crystal was found to be 1.7% greater than the interlayer spacing. Theoretical values of the energy of cohesion and the compressibility were calculated from the potential curve for the interaction between two semi-infinite crystals. They were $\Delta E_C = -330$ ergs/cm^2 and $\beta = 3.18 \times 10^{-12}$ cm^2/dyne, respectively. These compared favourably with the experimental values of $\Delta E_C = -260$ ergs/cm^2 and $\beta = 2.97 \times 10^{-2}$ cm^2/dyne.

A.

539.11

567. INFLUENCE OF EXCHANGE AND CORRELATION ON ELECTRON TRANSPORT IN METALS. R.Barrie.
Phys. Rev., Vol. 103, No. 5, 1581 (Sept. 1, 1956).

Various errors are pointed out in Blatt's calculation (Abstr. 4389/1956) of the change produced in the conductivity and thermoelectric power of metals when one uses the Bohm and Pines ϵ–k curve instead of the usual standard parabolic curve. The correct results are derived. E.H.Sondheimer

539.11

568. ELECTRON CHARACTERISTIC ENERGY LOSSES IN METALS AND COMPOUNDS. L.B.Leder.
Phys. Rev., Vol. 103, No. 6, 1721-6 (Sept. 15, 1956).

The characteristic energy loss spectra of electrons in the metals Al, C, Sb, Ca, Pb, Na and Te and compounds of these metals have been measured with an improved measuring technique designed to give more reliable intensity relationships, and it is found that, with the exception of Al_2O_3, the compound spectra show a decided similarity to the spectra of their parent metal spectra. Rudberg's premise that such a similarity is due to oxidation of the parent metal is shown not to hold. It is proposed that the characteristic losses, except in the case of Al, and possibly Be and Mg, are due to interband transitions. For Al, and possibly Be and Mg, the characteristic losses may be due to excitation of a free electron plasma. A.

539.11 : 548.7

569. ON THE EXISTENCE OF ZENER EMISSION. W.Franz.
Z. Naturforsch., Vol. 11a, No. 6, 522-3 (1956). In German.

Wannier's model (Abstr. 2269/1956) in which no conduction occurs below a certain threshold field, and which replaces the Zener effect, is considered to be physically unreliable and not plausible. The best single electron wave-functions are shown to be not of the form given by Wannier. C.G.Morgan

539.11 : 537.311.1

570. ADIABATIC APPROXIMATION AND INTERACTION TERMS IN THE THEORY OF NON-POLAR SOLIDS. A.Haug.
Z. Phys., Vol. 146, No. 1, 75-86 (1956). In German.

In the solution of the Schrödinger equation, it is shown that if one takes the adiabatic approximation and neglects the interaction terms, useful and physically meaningful formulae are obtained which may be used in the analysis of metallic conductivity. C.A.Hogarth

539.11 : 518.5

CALCULATION OF ATOMIC-WAVE FUNCTIONS IN SOLIDS. See Abstr. 5

MOLECULES 539.13

539.13

571. DIRECT MEASUREMENTS OF MOLECULAR ATTRACTIONS BETWEEN SOLIDS IN VACUO. B.V.Deryagin and I.I.Abrikosova.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 2, 214-17 (1956). In Russian.

Approximate value of the long-range forces between quartz plates of 1 cm^2 in area were obtained from Lifshits' theory and were in agreement with measurements of the attraction and the derived energy. Although Lifshits' theory applies only to vacuum it seems also significant for exchange forces between colloid particles in any dispersion medium. From the agreement of Lifshits' theory with these measurements it is concluded that molecular forces are based on electromagnetic forces, answering the problem posed by Lebedev. Measurements reported by Overbeck and Sparnay exceed greatly the values of Lifshits' theory, and are rejected. J.Jacobs

539.13

572. DIRECT MEASUREMENT OF MOLECULAR ATTRACTION OF SOLID BODIES. II. METHOD OF MEASUREMENT OF THE GAP. EXPERIMENTAL RESULTS. I.I.Abrikosova and B.V.Deryagin.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 3-13 (1956). In Russian.

For Pt I see Abstr. 8303 (1956). Results of measurements for fused quartz at distances between 0.08 and 1 μ are presented. The experimental data are in good agreement with the E.M.Lifshits theory which is valid for distances greatly exceeding the wavelength of the main ultraviolet absorption bands and which does not contain indefinite empirical constants. This agreement confirms the theory of E.M.Lifshits and also the electromagnetic nature of molecular forces suggested as early as 1894 by P.N.Lebedev. It is pointed out that the results of measurements of Overbeek and Sparnaay (Abstr. 3481/1953) yield results which exceed the theoretical values by almost 10^4 times, apparently as a result of electrostatic effects which were not eliminated. A.

539.13 : 533.7

573. ON THE KINETIC ENERGY OF MOLECULAR ELECTRONS IN COMPRESSED GASES. A.Solem and L.Jansen.
J. chem. Phys., Vol. 25, No. 4, 686-92 (Oct., 1956).

A low-density calculation of the change in kinetic energy of molecular electrons due to interactions is presented as a series in powers of the density. A detailed analysis is made of the contribution from the linear term. The interaction potential between two molecules is assumed to be of the Lennard-Jones (6–s) form with s equals 8, 10, 12, and 14. In addition, contributions due to directional forces such as quadrupole induction and quadrupole orientation forces and anisotropy in the London forces are taken into account. These directional forces are cut off inside the molecular diameter. In general, directional effects are of the order of a few percent of the total change in the kinetic energy. Among the directional effects, that due to quadrupole induction is predominant at high temperatures for the gases nitrogen, carbon monoxide, carbon dioxide, ethylene, and ethane; at low temperatures the anisotropy in the London forces predominates. It is shown that the change in kinetic energy is more sensitive to the repulsive part of the potential field than the second virial coefficient. A.

539.132

574. A DEVICE TO AVOID DIFFICULT INTEGRALS IN CALCULATIONS ON MOLECULAR STRUCTURE. S.Huzinaga.
Progr. theor. Phys., Vol. 14, No. 5, 492-3 (Nov., 1955).

Using the example of H_2^+, it is shown how the difficulties of integrations concerning electron–electron interactions can be avoided by describing, just as in an atom, all the electrons with reference to one single, appropriately chosen, centre in the molecule. W.A.Hepner

539.132 : 535.338.4

575. FRANCK–CONDON FACTORS $q_{v'v''}$ OF MOLECULAR BAND SYSTEMS AND THEIR INTERPOLATION. R.W.Nicholls.
J. chem. Phys., Vol. 24, No. 5, 1104-6 (May, 1956).

The use of $\bar{\alpha}\Delta r_e$ (Abstr. 1526/1954) as a transition para-

meter to specify a q-surface is discussed. A plot of q_{00} versus $x = (\omega_{eL}/\omega_{eS})\exp.(\bar{\alpha}\Delta r_e)$ shows that x may be a more useful parameter. G.Allen

539.132

576. ELECTRON IMPACT STUDIES OF THE DISSOCIATION ENERGIES OF N_2 AND H_2. R.Thorburn and J.D.Craggs.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 682-5 (June, 1956).

Previous methods for the determination of the dissociation energy of N_2, by spectroscopic and electron impact studies, have yielded widely different values. The Lozier apparatus (Phys. Rev., Vol. 52, 843, 1930; Phys. Rev., Vol. 46, 268, 1934) is used in conjunction with a mass spectrograph to obtain the kinetic energies of the positive atomic ions and their appearance potentials by observing a break in the ionization efficiency curve. The breaks in the curve for nitrogen correspond to the formation of N_2^+ and N^+ ions from N_2, and the appearance potentials of the N_2^+ ions are in good agreement with previous determinations. As a check the appearance potential of N^+ from N_2 is determined using the mass spectrometer; agreement is good. It is found by the application of retarding potentials and comparison with argon that the appearance potentials of the positive ions correspond to those of ions of zero kinetic energy. The products of dissociation are unexcited, giving a unique value of 9.8 ± 0.2 eV for the dissociation energy. The dissociation processes of hydrogen were repeated to confirm the performance of the instrument; agreement with previous results, assuming the products are unexcited, is good. A.J.Mee

539.132

577. THE ROTATIONAL ANALYSIS OF THE SINGLET SYSTEM A OF ZIRCONIUM OXIDE. U.Uhler and L.Akerlind.
Ark. Fys., Vol. 10, Paper 32, 431-46 (1956).

A rotational analysis of the u.v. band system A of zirconium oxide has been carried out. The bands probably form a $^1\Sigma$-$^1\Sigma$ transition. The 0, 0, 0, 1, 1, 0 and 2, 1 bands have been analysed. A perturbation was found in the level v' = 2. The isotope effect has been studied and lines belonging to the isotopes Zr^{91}, Zr^{92} and Zr^{94} besides the main isotope Zr^{90}, have been identified. The derived constants may be summarized in the following formulae: $B_v'' = 0.4241\text{-}0.0023\ (v'' + \frac{1}{2})$ D'' = 0.33 K; $B_v = 0.3951\text{-}0.0019\ (v' + \frac{1}{2})$ D' = 0.35 K; $r_e'' = 1.711$ A; $r_e' = 1.772$ A; $\omega_e' = 843.2_7$K; $\omega_e'x_e' = 3.0_4$K. The possibility that the bands are due to a $^1\Delta$-$^1\Delta$ transition is discussed. A.

539.132

578. GENERAL FORMULAS FOR KINETIC ENERGY MATRIX ELEMENTS OF IN-PLANE VIBRATION IN PLANAR MOLECULES. T.Shimanouchi.
J. chem. Phys., Vol. 25, No. 4, 660-1 (Oct., 1956).

General formulae are given in terms of internal coordinates of the bond stretching and bending type for in-plane vibration in planar molecules. The definition for the sign of bond angle makes those formulae independent of the mutual positions of atoms. An example is given. A.

539.132 : 539.133

579. MICROWAVE SPECTRUM AND MOLECULAR CONSTANTS OF NITROSYL BROMIDE. T.L.Weatherly and Q.Williams.
J. chem. Phys., Vol. 25, No. 4, 717-21 (Oct., 1956).

The microwave spectrum of NOBr has been studied in the region 20 000 to 40 000 Mc/s and an analysis made of the J = 2 → 3 transition. The following molecular constants were obtained.

	$NOBr^{79}$	$NOBr^{81}$
Rotational constants (Mc/s)		
A	83 340	83 340
B	3747.24	3722.49
C	3586.00	3563.34
Asymmetry parameter b	−0.001 012	−0.000 998
Quadrupole coupling components (Mc/s)		
χ_{aa}	388.3	325.5
χ_{bb}	−239.5	−200.2
χ_{cc}	−148.8	−125.3

The structural parameters obtained from these are d(N–O) = 1.15 A, d(N–Br) = 2.14 A, d(O–Br) = 2.81 A, and ∠Br–N–O = 114°. The interatomic distances are compared with electron diffraction results, and a brief interpretation of the quadrupole coupling in terms of chemical bonds is given. A.

539.132

580. THE OSCILLATOR STRENGTHS OF THE 1sσ-2sσ, 1sσ-3dσ AND 2sσ-3dσ TRANSITIONS OF HeH^{2+}. A.Dalgarno, N.Lynn and E.J.A.Williams.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 610-14 (Aug., 1956).

The oscillator strengths of the 1sσ-2sσ, 1sσ-3dσ and 2sσ-3dσ transitions of HeH^{2+} are calculated from the exact two-centre wave-functions. A comparison is made with results obtained from the L.C.A.O. approximation with and without mixing, both the dipole length and dipole velocity formulae being used in each case. A.

539.132

581. THE WEIZSÄCKER INHOMOGENEITY CORRECTION IN THE STATISTICAL MOLECULAR MODEL. W.Kołos.
Acta phys. Hungar., Vol. 6, No. 1, 133-41 (1956). In German.

The importance of applying this correction to the kinetic energy in the statistical calculation of the energy of a molecule is demonstrated for N_2. The Ritz method, with two variation parameters in the electron density function is used to calculate the energies of the N_2 molecule and N atom with and without the Weizsäcker correction. The repulsion energy is smaller when the correction is taken into account. In neither case is binding obtained and this is attributed to the rough approximations involved in the energy calculations. The application of the correction to the more accurate calculations made by Sheldon (Abstr. 8959/1955) may lead to a stable molecule. G.Allen

539.132

582. THE INFLUENCE OF THE CORRELATION FACTOR $(1 + pr_{12})$ ON THE CALCULATIONS OF THE GROUND STATE OF THE HYDROGEN MOLECULE. F.Berencz.
Acta phys. Hungar., Vol. 6, No. 1, 149-52 (1956). In German.

A comparison is made of the Heitler–London, Hund–Mulliken and modified Hund–Mulliken eigenfunctions with and without the above correlation factor. The greatest correction of dissociation energy occurs in the case of the Hund–Mulliken eigenfunction, which does not originally allow for electron correlation. J.Jacobs

539.132

583. THE NATURE OF THE INTRAMOLECULAR HYDROGEN BOND. D.N.Shigorin, M.M.Shemyakin, L.A.Shchukina, M.N.Kolosov and F.A.Mendelevich.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 4, 672-5 (1956). In Russian.

From analysis of the measured frequencies of valency vibrations of the OH group in a number of organic compounds, it is concluded that when hydrogen bonds are present, the magnitude of π-electron interaction depends (1) on the presence of single system of conjugated double bonds, embracing both a ring with a hydrogen bond, and the other part of the molecule; (2) on whether the number of units in this system is odd or even; (3) on whether the rings containing the hydrogen bonds and the remaining parts of the system are planar or not; (4) on the number and character of the distribution of π-electrons in the system. The distribution of electron density is given by $S = S_0 \mp \Delta S.n \pm (1/6)\,\Delta S.n_1$ (n and n_1 = numbers of nearest and furthest neighbours). R.C.Murray

539.132

584. l-TYPE DOUBLING IN N_2O. J.N.Shearer, T.A.Wiggins, A.H.Guenther and D.H.Rank.
J. chem. Phys., Vol. 25, No. 4, 724-9 (Oct., 1956).

Doublet separations in nine π–π bands of the linear non-symmetrical molecule N_2O have been measured in the region 1.5-2.4 μ. In addition to the doublet splitting caused by the ν_2 motion, it is shown that the parallel modes ν_1 and ν_3 contribute measurable amounts to this splitting in π states, so that the doubling constant q_v is a function of all three vibrational quantum numbers v_i. The data fit an equation of the form $q_v = \Sigma_i Q_i(v_i + 1)$ within experimental error, where i = 1, 2, 3, and the Q_i are called the Coriolis constants. The experimentally determined values are $Q_1 = 1.40 \times 10^{-4}$, $Q_2 = 3.40 \times 10^{-4}$ and $Q_3 = -0.19 \times 10^{-4}$ cm^{-1}. A.

539.132

585. ELECTRONIC STATES AND POTENTIAL ENERGY DIAGRAM OF THE IODINE MOLECULE. L.Mathieson and A.L.G.Rees.
J. chem. Phys., Vol. 25, No. 4, 753-61 (Oct., 1956).

The existing spectroscopic data on the iodine molecule have been reanalysed, some new assignments proposed, and a potential energy diagram computed for some ten electronic states up to 55 000 cm^{-1}. In particular, the following new assignments have been made for the upper levels of certain absorption bands — (1) a repulsive $^3\Sigma_u^+(0_u^-)$ to the weak absorption at λ2700 in iodine vapour, (2) an ionic $^3\Sigma_u^-(0_u^+)$ to the PRKM and Skorko band systems, and (3) a state arising from the mixing of a homopolar $^3\Pi_{0^+u}(0_u^+)$ and an ionic $^1\Sigma_u^+(0_u^+)$ to the Cordes bands. In addition, the λ 3416 and λ 4300 "continua" have each been interpreted satisfactorily as a region of unresolved, overlapping bands with a lower limiting frequency. Other states lying in the region 40 000-55 000 cm^{-1} have been established. A.

539.132

586. ROTATIONAL INTENSITY DISTRIBUTION OF THE OH BAND. M.Ninomiya.
J. Phys. Soc. Japan, Vol. 11, No. 9, 970-4 (Sept., 1956).

The anomaly of the rotational intensity distribution distribution of the OH band excited by vacuum discharge is explained as due to the existence of two unstable excited states of H_2O molecules, through which a radical OH in the excited states ($^2\Sigma$) is produced. It is shown that the intensity distribution of the band excited by electrons with known energies depends upon the energy of impinging electrons in the electron impact experiments. The feature of the distribution of the band intensities from molecules excited by usual electric discharge can be understood as to be determined by the energy distribution of electrons in discharge tubes. A.

539.132

587. MOBILITY OF π-ELECTRONS IN HETEROGENEOUS LINEAR MOLECULES. R.N.Beale.
Nature (London), Vol. 178, 37-8 (July 7, 1956).

Oscillator strengths for the lowest energy $\pi \rightarrow \pi^*$ transition in the electronic absorption spectra of compounds of the type Ph—X and Ph—X—Ph (X = —CO—, —N=N— and —CH : N.N : CH—) are measured and compared with Kuhn's treatment of polyene chains. Only the —CH : N.N : CH— group makes a contribution to the transition intensity. Since no marked decrease in intensity and no changes in shape or position of the absorption band occurs, the conjugated hetero groups in the chain of elongated planar molecules cause no decrease in the mobility of the carbon π-electrons. G.Allen

539.132

588. NUCLEAR SPIN—LATTICE RELAXATION TIMES OF AROMATIC AND ALIPHATIC PROTONS. G.W.Nederbragt and C.A.Réilly.
J. chem. Phys., Vol. 24, No. 5, 1110-1 (May, 1956).

The spin—lattice relaxation time for protons in benzene is 19.3 sec and for a 11% benzene solution in CS_2 60 sec. The times for ring and CH_3 protons in toluene are 16 and 9, for p-xylene 14 and 7½ and for mesitylene 10 and 5 sec respectively. D.H.Whiffen

539.132

589. PROTON MAGNETIC RESONANCE OF HYDROCARBONS. J.A.Pople.
J. chem. Phys., Vol. 24, No. 5, 1111 (May, 1956).

Consideration of the nature and spatial arrangement of the precessing electrons shows that the field generated in the ring electrons in benzene reinforces the external magnetic field at the protons and is of the correct order of magnitude to account for a nuclear magnetic resonance chemical shift of $+ 0.14 \times 10^{-6}$ for benzene relative to ethylene. In acetylene a negative term is expected in agreement with experiment. D.H.Whiffen

539.132 : 538.222

590. HYPERFINE STRUCTURE AND ELECTRON DENSITIES IN AROMATIC FREE RADICALS. E.de Boer.
J. chem. Phys., Vol. 25, No. 1, 190 (July, 1956).

It has been shown that a linear relationship may be assumed between odd electron density at the C atom in an aromatic system and the hyperfine splitting due to the proton bound to this C atom. Using m.o. approximations the π-electron distribution in anions of naphthalene, anthracene, and biphenyl were calculated, and hence paramagnetic absorption spectra with 17, 21, 9 peaks respectively were predicted. This proved in agreement with the experimental results described. J.Jacobs

539.132

591. INTENSITY OF NUCLEAR QUADRUPOLE SPECTRA OF SOLID SOLUTIONS. A.Monfils and D.Grosjean.
Physica, Vol. 22, No. 6, 541-4 (June, 1956). In French.

The diminution in the intensity of the quadrupole line of Cl^{35} in p-dichlorobenzene when various impurities (naphthalene and homologues of p-dichlorobenzene) are present has been determined. G.I.W.Llewelyn

539.132 : 541.124

592. POLARIZATION ENERGY AND CHEMICAL REACTIVITY. C.Duculot.
C.R. Acad. Sci. (Paris), Vol. 243, No. 4, 378-80 (July 23, 1956). In French.

The matrix C of the molecular orbital coefficients is identical with Ω introduced earlier (Ibid., Vol. 242, No. 22, 2641, May 28, 1956). The polarization of an atom due to substitution or addition causes a perturbation, affecting both the Coulomb and exchange integrals. The corresponding changes in energy eigenvalues are derived. The equation may also be considered as defining an index of polarization on which the chemical reactivity depends. J.Jacobs

539.132

593. ON THE EXPANSION FORMULA OF ATOMIC ORBITALS IN SPHERICAL HARMONICS AROUND ANOTHER CENTER. Y.Tanabe.
J. Phys. Soc. Japan, Vol. 11, No. 9, 980-6 (Sept., 1956).

A general formula for the expansion coefficient of one atomic orbital in spherical harmonics around another centre, which is useful in numerical evaluation of molecular integrals, is derived and applied to the evaluation of certain two-centre integrals. A.

539.132

594. INTERACTION BETWEEN ELECTRONS IN TWO-DIMENSIONAL FREE-ELECTRON MODEL FOR CONJUGATED SYSTEMS. S.Huzinaga.
Progr. theor. Phys., Vol. 15, No. 5, 495-500 (May, 1956).

An attempt is made to include the effects of electron—electron interactions into the two-dimensional free-electron model of Platt for conjugated systems (Abstr. 9467/1954). The method is explained in the case of the naphthalene molecule as a simple example. The excitation energies of the first four singlets are calculated. The agreement between theory and experiment is moderate. The method may be applied, with a reasonable amount of labour, to larger systems to which the applications of the usual theories based on atomic orbitals may not be feasible. A.

539.132 : 537.311.33

595. HYDROGEN-LIKE MODEL OF THE VALENCY IN SEMICONDUCTING COMPOUNDS OF THE TYPE $A^{III}\,B^{V}$. W.Heywang and B.Seraphin.
Z.Naturforsch., Vol. 11a, No. 6, 425-9 (June, 1956). In German.

The valence bonds are discussed on the basis of the Heitler-London model modified by the inclusion of ionic states. E.P.Wohlfarth

539.132 : 539.11

TWO-CENTRE INTEGRALS OVER THE ATOMIC SPHERE.
See Abstr. 564

539.133

596. CALCULATION OF DIPOLE MOMENTS OF THE TETRA-SUBSTITUTED BENZENES. K.V.Gopala Krishna.
Indian J. Phys., Vol. 30, No. 4, 206-9 (April, 1956).

A general method is given for the calculation of dipole moments of 1, 2, 3, 4-tetra-substituted benzenes taking into account the dielectric constants of internuclear space in the field equations as suggested by Frank. The calculated value is given for 1, 2, 3, 4-tetra-chloro benzene for which the observed value is available and from a comparison between the calculated and the observed values it is seen that the agreement will be considerably improved when calculations are made using the field equations of Frank instead of the field equations of Smallwood and Herzefeld applied for the disubstituted compounds. A.

539.133

597. ACCURACY OF THE ELECTRON DIFFRACTION METHOD FOR THE DETERMINATION OF STRUCTURE PARAMETERS IN THE GASEOUS STATE. A.Almenningen and O.Bastiansen.
Research Correspondence, Vol. 9, No. 9, S 35-S 36 (Sept., 1956).

Of the various methods available for the determination of structure parameters, that of electron diffraction appears to give the most consistent results and to be capable of further development. R.Reed

539.133

598. CHANGES OF SHAPE OF MOLECULES DUE TO ELECTRONIC EXCITATION. C.K.Ingold.
J. Chim. phys., Vol. 53, No. 6, 472-9 (June, 1956). In French.

The spectroscopic evidence for the structures of C_2H_2, HCHO, and C_6H_6 in the first excited state is reviewed. No references. G.Allen

ATOMS. NUCLEUS. ISOTOPES 539.15

539.152.1

599. INTERACTION OF HEAVY NUCLEI WITH NUCLEONS. P.Gombás.
Acta phys. Hungar., Vol. 5, No. 4, 511-18 (1956). In German.

This interaction, for a nucleon in the nucleus, is approximately represented by a sum of potential interactions describing: (a) Coulomb interaction, (b) nuclear interaction, (c) exchange forces. The potential and nuclear density are given for a Majorana force and several types of radial dependence of the potential. G.E.Brown

539.152.1

600. THE THEORETICAL DETERMINATION OF SOME CONSTANTS OF THE $_{82}Pb^{208}$ NUCLEUS BASED ON THE STATISTICAL NUCLEAR MODEL. D.Kisdi.
Acta phys. Hungar, Vol. 5, No. 4, 519-27 (1956). In German.

Using the modified potentials of Gombás (preceding abstract) for the interaction of a heavy nucleus with nucleons, the binding energy of the last neutron in $_{82}Pb^{209}$ and the last proton in $_{83}Bi^{209}$ have been determined. The cross-section for the scattering of thermal neutrons by $_{82}Pb^{208}$ and the half-life for β-decay of $_{82}Pb^{209}$ have also been calculated. The values obtained are $E_n = -2.65$ MeV, $E_p = -7.75$ MeV, $\sigma = 6.19$ barns and $T = 2.94$ hours. The calculated and experimental values show good agreement in all four cases. D.J.A.Prowse

539.152.1

601. REPULSIVE FORCES AND THE PROBLEM OF SATURATION IN THE NUCLEUS. G.Szamosi.
Bull. Acad. Polon. Cl. 3, Vol. 3, No. 7, 361-3 (1955).

Shows that the non-linearity of the "relativistic potential" automatically gives rise to quantum-mechanical many-body forces between nucleons. Hence the effect of such a potential may be considerably greater than that of a repulsion introduced phenomenologically, or even that arising from a two-body treatment and may therefore in itself suffice to explain nuclear saturation. J.W.Gardner

539.152.1

602. THE ALPHA-PARTICLE AND SHELL MODELS OF THE NUCLEUS. J.K.Perring and T.H.R.Skyrme.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 600-9 (Aug., 1956).

It is shown that it is possible to write down α-particle wave-functions for the ground states of Be^8, C^{12} and O^{16}, which become, when antisymmetrized, identical with shell-model wave-functions. The α-particle functions are used to obtain potentials which can then be used to derive wave-functions and energies of excited states. Most of the low-lying states of O^{16} are obtained in this way, qualitative agreement with experiment being found. The shell structure of the 0^+ level at 6.06 MeV is analysed, and is found to consist largely of single-particle excitations. The lifetime for pair-production is calculated, and found to be comparable with the experimental value. The validity of the method is discussed, and comparison made with shell-model calculations. A.

539.152.1

603. TWO-NUCLEON POTENTIAL OF INTERMOLECULAR TYPE AND NUCLEAR SATURATION. D.D.Ivanenko and B.K.Kerimov.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 105-12 (1956). In Russian.

A statistical nuclear model with uniformly distributed nucleons has been investigated on the assumption of a two-nucleon interaction potential of the Leonard-Jones type with a rigid wall. It is shown that by suitably choosing the potential parameters saturation can be obtained. A.

539.152.1

604. EFFECT OF A SHORT-RANGE REPULSIVE INTERACTION IN THE (jj) COUPLING SHELL MODEL. G.Györgyi.
Nuclear Physics, Vol. 1, No. 5, 332-4 (1956).

The most stable level in the $(g_{9/2})^{\pm 3}$ configuration is sometimes the $I = 7/2$. This however is not expected with the usual monotonic two-nucleon central potentials although the level spacing of the $I = 7/2$ and $I = 9/2$ is quite small. It is shown that this can be explained within the framework of the single-particle shell model by the assumption of a short range repulsive interaction between nuclei. The strength of this repulsion necessary to make the 7/2 and 9/2 levels cross-over has been computed. The effects of a repulsive potential on the states of $(d_{5/2})^3$ have also been examined. D.J.A.Prowse

539.152.1

605. ON THE FOUNDATIONS OF THE UNIFIED NUCLEAR MODEL. II. T.Marumori and E.Yamada.
Progr. theor. Phys., Vol. 13, No. 5, 557-9 (May, 1955).

For Pt I see Abstr. 3082 (1956). With the aid of a subsidiary condition, a many-particle system is described in terms of the particle motion, the density, and velocity potential, of a quantized fluid. P.T.Matthews

539.152.1

606. NUCLEAR DENSITY AND THE DISTRIBUTION OF ORBITAL MOMENTUM IN NUCLEI. B.K.Kerimov and A.B.Dzhavadov.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1065-9 (1956). In Russian.

The relation between the energy minimum obtained before (Abstr. 8324/1956) and the distribution of the mean square orbital momentum of nucleons in the nucleus has been found. The number of particles in the nucleus, for which nucleons in the l-state first appear, has been determined. A.

539.152.1

607. Z_A TERM IN THE MASS FORMULA. A.N.Saxena.
Indian J. Phys., Vol. 29, No. 10, 501-2 (Oct., 1955).

Addition to Abstr. 9055 (1955). Values of Z_A for odd A nuclei can be obtained from experimental plots of the β-disintegration energies. A.O.Stanesby

539.152.1

608. ON THE BINDING ENERGIES OF VERY LIGHT NUCLEI. S.Suekane and W.Watari.
Progr. theor. Phys., Vol. 14, No. 5, 490-2 (Nov., 1955).

Calculations for H^3 and He^3 with an oscillator potential as the interaction between two nucleons. The parameters of this potential are taken so as to fit deuteron data, except for an adjustable force range r_0. Results agree with the experimental values for the two nuclei using nearly equal values of r_0. L.Pincherle

539.152.1

609. HYPERFINE STRUCTURE OF RADIOACTIVE SILVER $^{111}_{47}Ag$. G.K.Woodgate and R.W.Hellwarth.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 581-7 (Aug., 1956).

An atomic beam apparatus is described with which the nuclear spin and hyperfine structure separation of the ground state of the radioactive isotope Ag^{111}_{47} have been found. The nuclear spin is $I = \frac{1}{2}$, in agreement with the result of McGinnis and of Lemonick and Pipkin. The other experimental results are: $\Delta\nu(^{111}Ag) = 2204.54 \pm 0.05$ Mc/s, $g_J(Ag) = 2.0023\,5 \pm 0.000\,12$, $\mu_I(^{111}Ag) = -0.145 \pm 1$ nuclear magnetons. A.

539.152.1

610. THERMAL EXPANSION COEFFICIENT OF NUCLEI. M.A.Ziegler.
Acta phys. Hungar., Vol. 5, No. 4, 537-40 (1956).

The dependence of the nuclear radius on excitation energy is examined. An expansion coefficient, defined in the usual way, is calculated assuming various nuclear models. The values for the coefficients so obtained do not differ widely, the best value being $6 \times 10^{-13} K^2$ (deg.abs.)$^{-1}$, where $K = 0.86 \times$

10^{-10} MeV (deg.abs.)$^{-1}$. An excitation energy of 100 MeV gives an increase in radius of only 1%. D.J.A Prowse

539.152.1

611. THEORY OF EXCITATION ENERGIES OF HEAVY NUCLEI. L.P.Rapoport and Yu.M.Butusov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 6, 1037-40 (1956). In Russian.

Following Süssman (Abstr. 2989/1955) the degrees of freedom are separated between those of individual and collective motion in the Hamiltonian. The mean energy of each part of the Hamiltonian is calculated statistically for a given temperature θ. G.E.Brown

539.152.1 : 535.37

612. NUCLEAR RESONANCE FLUORESCENCE IN Ni^{60}. F.R.Metzger.
Phys. Rev., Vol. 103, No. 4, 983-7 (Aug. 15, 1956).

The gamma radiation emitted by a gaseous source of $Co^{60}Cl_2$ has been used to excite the 1.33 MeV level in Ni^{60}. The angular distribution of the resonance radiation characterizes the spin of the 1.33 MeV excited state as 2 and the spin of the Ni^{60} ground state as 0. A resonance fluorescence self-absorption experiment has been performed and from it a mean life of $(1.1 \pm 0.2) \times 10^{-12}$ second has been calculated for the 1.33 MeV excited state of Ni^{60}. A.

539.152.1

613. COULOMB EXCITATION OF ROTATIONAL STATES OF THE NUCLEI Gd^{155} AND Gd^{157}. J.H.Bjerregaard and U.Meyer-Berkhout.
Z. Naturforsch., Vol. 11a, No. 4, 273-7 (April, 1956). In German.

Gd^{155} and Gd^{157} were bombarded with protons and α-particles of 1.75 MeV and the energies (60.2 ± 1.0, 146 ± 2 and 54.6 ± 1.0, 132 ± 2 keV) and excitation cross-sections of their first and second rotational states were measured. A.O.Stanesby

539.152.1

614. PERTURBATION OF THE ENERGY LEVELS OF A PARTICLE IN A SPHEROIDAL HOLE. S.Soriano.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 657-60 (Sept., 1956). In Italian.

A brief mathematical consideration. The result may be interpreted as the variation in the energy of the nucleons, due to the deformation of the nucleus. The energy variations are calculated using the first-order perturbation terms. These contain a normalizing factor which allows the individual energy contributions of the nucleons in each complete shell to be neglected, and their total contribution to the energy of deformation to be considered as it is in the liquid drop model. J.J.Phipps

539.152.1

615. LOWEST ODD-PARITY STATES IN EVEN-EVEN NUCLEI. H.Morinaga.
Phys. Rev., Vol. 103, No. 2, 503-4 (July 15, 1956).

The lowest known states are plotted against nucleon number and several marked regularities are analysed. P.T.Matthews

539.152.1

616. REGULARITIES IN THE LEVEL SCHEMES OF HEAVY EVEN-EVEN NUCLEI. G.Scharff-Goldhaber.
Phys. Rev., Vol. 103, No. 3, 837-8 (Aug.1, 1956).

An abrupt transition governed solely by the number of neutrons in the nucleus is known to occur at $A \approx 150$. For $N \leq 88$ the energy of the first excited state is 300 keV (E_1) and $E_2/E_1 = 2.2$, where E_2 is the energy of the second excited state with even spin and parity. This state is in most cases 2+ though sometimes 4+. For $N \geq 90$ the spin sequence 0+, 2+, 4+ occurs and $E_1 < 125$ keV and $E_2/E_1 = 3.3$. A similar behaviour is apparent among the heavy nuclei below the rotational pattern which starts at $Z = 88$. It is shown by considering the level scheme of Em^{222} that it is caused almost solely by protons. The critical numbers are almost the same for the two transitions, $N = 88$-90 and $Z = 86$-88. D.J.A.Prowse

539.152.1

617. NOTE ON THE NUCLEAR LEVEL OF SPIN 2^+. M.Sakai.
Progr. theor. Phys., Vol. 15, No. 4, 416-17 (April, 1956).

A table of nuclei with excited level 2^+ based on gamma–gamma angular correlation measurements. The proton numbers lie near the magic numbers. P.T.Matthews

539.152.1

618. NUCLEAR SPINS OF Dy 163 AND Dy 161. K.Murakawa.
J. Phys. Soc. Japan, Vol. 11, No. 7, 804-5 (July, 1956).

A previous examination of the hyperfine structure of the dysprosium spectrum indicated that the spins of Dy^{163} and Dy^{161} were equal and probably 7/2. A more critical review shows that all that can really be concluded unambiguously about the spins is that they must be greater than 1/2. A detailed classification of the spectrum now indicates that they are 3/2. The ratio of the magnetic moments $\mu(Dy^{163})/\mu(Dy^{161}) = 1.07 \pm 0.05$ and the quadrupole moment ratio is about 1. These results are in disagreement with recent theoretical work which gives the spin of Dy^{161} as 5/2. D.J.A.Prowse

539.152.1

619. THE SPIN AND MAGNETIC MOMENT OF ^{116}*In. P.B.Nutter.
Phil. Mag. (Ser. 8), Vol. 1, No. 6, 587-8 (June, 1956).

The transitions $\Delta F = 0$, $\Delta m = \pm 1$ of In^{116} of half-life 52 min in the ground $p_{1/2}$ state were observed in atomic beams. The observed constants were $I = 5$, hyperfine splitting 8670 ± 170 Mc/s, $\mu = +4.21 \pm 0.08$ n.m. This moment is consistent with calculated moments with j-j coupling between odd nucleons with the configurations $g_{9/2}\, s_{1/2}$, $g_{9/2}\, d_{5/2}$ or $g_{9/2}\, g_{7/2}$ but not with $g_{9/2}\, d_{3/2}$ or $g_{9/2}\, h_{11/2}$. D.H.Whiffen

539.152.1 : 530.145

SUPPLEMENTARY VARIABLES METHOD FOR NUCLEAR MODELS. See Abstr. 115.

539.152.2

620. QUADRUPOLE MOMENT OF THE U^{233} NUCLEUS. A.G.Zimin and N.M.Yashin.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 2, 283-4 (1956). In Russian.

A detailed analysis of the hyperfine structure of the spark spectrum is carried out, giving $Q_{opt} \cong 13 \times 10^{-24}$ cm^2. G.E.Brown

539.152.2

621. HYPERFINE STRUCTURE AND NUCLEAR MOMENTS OF GADOLINIUM FROM PARAMAGNETIC RESONANCE SPECTRUM. W.Low.
Phys. Rev., Vol. 103, No. 5, 1309 (Sept. 1, 1956).

The hyperfine structure in the paramagnetic resonance spectrum of Gd^{3+} was resolved and a nuclear spin of $\frac{3}{2}$ was found for each of the two odd isotopes Gd^{155} and Gd^{157}. The ratio of the nuclear magnetic moments is $\mu_I(Gd^{155})/\mu_I(Gd^{157}) = 0.75 \pm 0.07$. The hyperfine structure in the $^2S_{7/2}$ state of Gd^{3+} arises probably from unpaired s-electron states which are admixed to the ground state by configurational interaction. Assuming the same degree of configurational interaction in Gd^{3+} as in isoelectronic Eu^{2+}, one finds the ratio $\mu_I(Eu^{151})/\mu_I(Gd^{157}) = 11.3$. If one takes $\mu_I(Eu^{151}) = 3.6$ nm, the values of the moments of Gd are $\mu_I(Gd^{157}) = 0.32$ and $\mu_I(Gd^{155}) = 0.24$ nm. The experiments were made on single crystals of $LaCl_3.7D_2O$ and $Bi_2Mg_3(NO_3)_{12}.24H_2O$ using enriched isotopes. A.

539.152.2 : 531.231

622. MOMENTS OF INERTIA OF FREELY ROTATING SYSTEMS. H.J.Lipkin, A.de-Shalit and I.Talmi.
Phys. Rev., Vol. 103, No. 6, 1773-5 (Sept., 1956).

A formula is derived for the moment of inertia of a freely rotating system. Although this formula is similar in form to the one derived by Inglis for a system of particles in an externally rotated potential, there are certain significant differences. The meaning of these differences is discussed and an attempt is made to clarify the question of the validity of the Inglis formula in the case of real nuclei. A.

539.152.2

623. NUCLEAR MOMENTS OF INERTIA DUE TO NUCLEON MOTION IN A ROTATING WELL. D.R.Inglis.
Phys. Rev., Vol. 103, No. 6, 1786-95 (Sept. 15, 1956).

A model of a deformed nucleus in which the spheroidal collective field is steadily cranked about a fixed axis, as introduced in previous papers, serves as a convenient approximation expected to reproduce some of the dynamic inertial properties of the collective motion. The independent-nucleon behaviour in a rotating harmonic oscillator potential, deformed by the presence of the open-shell nucleons, gives the rigid-rotation moment of inertia and is discussed here with an

attempt at graphic clarity. This result is much larger than observed and attention is here focused on the shortcomings of the harmonic oscillator approximation, although, as suggested by Bohr and Mottleson, the discrepancy may also be largely due to the internucleon interactions which have not been calculated adequately and are here neglected. The 1d-2s shell is treated as a tractable illustrative case. The characteristic harmonic-oscillator degeneracy of the undeformed levels within the magic-number groups, such as the 1d and 2s levels, profoundly affects the perturbation calculation of the moment of inertia through the energy denominators. Removing this degeneracy by lowering the states of high l (as required in heavier nuclei for the magic numbers) has the effect of increasing the calculated moment of inertia above the rigid-rotation value in most cases near the beginning of the shell and reducing it in most cases near the end of the shell. The preponderance of prolate deformation is also discussed. A.

539.152.2

624. THEORIES OF NUCLEAR MOMENTS. R.J.Blin-Stoyle.
Rev. mod. Phys., Vol. 28, No. 1, 75-101 (Jan., 1956).

Contents: (1) introduction; (2) electromagnetic multipole moments; (3) exchange currents and velocity dependent forces; (4) nuclear moments of H^2, H^3, He^3; (5) nuclear models; (6) the magnetic moments of odd-A nuclei; (7) electric quadrupole moments of odd-A nuclei; (8) magnetic dipole and electric quadrupole moments of odd—odd nuclei; (9) moments of excited states of nuclei; (10) nuclear magnetic octupole moments; tables of moments of odd-A nuclei. Conclusions: The single-particle model gives only the general trend of the magnetic dipole and octupole moments, while most electric quadrupole moments do not agree with the model. The individual particle model with configurational mixing explains all moments except those of nuclei lying in the approximate ranges $150 < A < 190$ and $A > 225$. To explain the large nuclear quadrupole moments of these nuclei it is essential to appeal to collective motion. Nuclear moments cannot in general be taken as a good guide to the purity or otherwise of nuclear states. L.Pincherle

539.152.2 : 538.221

625. POLARIZATION OF THE NUCLEI OF FERROMAGNETIC ATOMS. G.R.Khutsishvili.
Zh. éksper. teor. Fiz., Vol. 29, No. 6(12), 894 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 744 (July, 1956).

The nuclei of a ferromagnetic may be polarized by cooling to a very low temperature, and imposing an external magnetic field exceeding the saturation field. P.T.Matthews

539.152.2

626. A NUCLEAR MAGNETIC RESONANCE APPARATUS. A.K.Saha, B.M.Banerjee, T.P.Das, D.K.Roy, S.K.Ghosh Roy and T.Ghose.
Indian J. Phys., Vol. 30, No. 5, 211-41 (May, 1956).

Following in the main Gutowsky's model, a nuclear magnetic resonance apparatus has been set up in this laboratory. It includes both Purcell's double bridge and marginal oscillator circuit for the detection of nuclear resonance signal. A Bloch head arrangement also, has recently been set up. Detailed account of the instrumentation is presented. Some records of the signal obtained by different techniques are also given. A.

539.152.2 : 548.7

627. ZEEMAN SPLITTING OF NUCLEAR QUADRUPOLE RESONANCE LINE OF IODINE. K.Tsukada.
J. Phys. Soc. Japan, Vol. 11, No. 9, 956-63 (Sept., 1956).

Zeeman patterns of the nuclear quadrupole resonance line of I^{127} were studied with a single crystal of iodine at medium and weak magnetic fields. The asymmetry parameter of coupling, η, and the angle between bond axis of the iodine molecule and crystallographic c axis, φ, were determined from the pattern at a medium magnetic field of about 120 gauss. The result was $\eta = -0.16 \pm 0.01$ at 14°C when crystallographic b axis was chosen as x axis and $\varphi = 31^\circ 38' \pm 60'$. The absolute value of η is in accord with the value obtained by the two resonance frequencies, i.e. 0.151 ± 0.001 at 11°C. φ agrees with that obtained by the X-ray diffraction, $32^\circ 4'$. At a weak magnetic field, Zeeman patterns of the fine structure of iodine were examined at three directions of magnetic field against the iodine crystal, i.e. the b axis, the c axis and the direction of 60° from the b axis in the bc plane. Behaviour of the super-regenerative detector used for these N.Q.R. measurements was studied and the observed shape of the resonance line is discussed. A.

539.152.2 : 548.7

628. STRUCTURE OF NUCLEAR QUADRUPOLE RESONANCE LINE. I. SOLID IODINE. S.Kojima, S.Ogawa, S.Hagiwara, Y.Abe and M.Minematsu.
J. Phys. Soc. Japan, Vol. 11, No. 9, 964-9 (Sept., 1956).

The complex structure of the line which was found in the nuclear quadrupole resonance in solid iodine was studied with recording instruments. The recorded pattern of the low-frequency line spread in the range of about 80 kc/s and resolved into five lines at least. The pattern changed considerably when the radiofrequency field was orientated with respect to the crystallographic axes. The structure was found to be caused by the electron-coupled spin—spin interaction. A.

539.152.2

629. KNIGHT SHIFT MEASUREMENTS FOR Ba^{135}, Ba^{137}, Cd^{111}, AND Cd^{113}. T.J.Rowland.
Phys. Rev., Vol. 103, No. 6, 1670-1 (Sept. 15, 1956).

The shift of the nuclear magnetic resonance frequency caused by the paramagnetism of the conduction electrons has been measured using a nuclear induction spectrometer. The values of the relative isotropic shift are $(0.403 \pm 0.002)\%$ for barium and $(0.415 \pm 0.004)\%$ for cadmium. The latter absorption is markedly anisotropic, the shifts perpendicular and parallel to the c-axis being $(0.401 \pm 0.004)\%$ and $(0.444 \pm 0.004)\%$, respectively. A.

539.152.2

630. SHAPE OF RESONANCE CURVES IN ATOMIC BEAM EXPERIMENTS. G.K.Woodgate and R.W.Hellwarth.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 588-92 (Aug., 1956).

In magnetic resonance experiments with atomic beams an atom is often exposed to a radio-frequency field whose amplitude varies along the path of the beam. To obtain an estimate of the shape of the resonance line to be expected with various radio-frequency loops, the Fourier transform of a function resembling the amplitude of the radio-frequency field has been taken in each case. These transforms are compared with experimental curves, and qualitative agreement is found. A.

539.152.2

631. ON THE MEASUREMENT OF NUCLEAR MAGNETIC RELAXATION TIMES FROM THE FREE PRECESSION MOTIONS. G.Laukien.
Z. Naturforsch., Vol. 11a, No. 4, 266-73 (April, 1956). In German.

Short spin—spin nuclear relaxation times are obtained from the exponential decay curve excited with a high frequency pulse. Longer times are obtained using two pulses and observing the echo amplitude as a function of pulse interval. The methods proposed eliminate the effects of magnetic field inhomogeneity. Spin—lattice relaxation times are obtained from the amplitude of the second signal as a function of the pulse interval or from the position of the amplitude minimum of the first pulse. The full theory and discussion of errors are given together with an experimental example. D.H.Whiffen

539.152.2 : 538.222

632. PULSE TECHNIQUE MEASUREMENTS OF THE SPIN-LATTICE AND THE SPIN-SPIN RELAXATION TIMES OF PROTONS IN AQUEOUS SOLUTIONS OF PARAMAGNETIC IONS. G.Laukien a d J.Schlüter.
Z. Phys., Vol. 146, No. 1, 113-26 (1956). In German.

The spin-lattice, T_1, and the spin-spin, T_2, relaxation times for protons were measured for solutions of Fe^{+++}, Cr^{+++}, Mn^{++}, Cu^{++}, Ni^{++}, Co^{++} and Gd^{+++} ions by the pulse techniques of an earlier paper (see preceding abstract). $1/T_1$ and $1/T_2$ were independent of the nature of anion and proportional to the concentration and to the square of the magnetic moment of the ion in agreement with the theory of Bloembergen, Purcell and Pound (Abstr. 2529/1948). T_1/T_2 varies from 1.3 for Ni^{++} to 7.1 for Mn^{++} in distinction to 1.01 as given by the theory. At low Fe^{+++} concentrations both T's increase more rapidly than expected as a result of isopolybase formation.

D.H.Whiffen

539.153

633. THE SELF-CONSISTENT FIELD FOR THE BASIC CONFIGURATION OF ATOMS OF HELIUM TYPE. G.K.Tsyunaĭtis., V.V.Kibartas and A P.Yutsis.
Optika i Spektrosk., Vol. 1, No. 1, 5-8 (1956). In Russian.

The field equation is solved for the basic configurations of H^-, B^{+3} and C^{+4} and values determined for the energy of atoms of such types. Theoretical results are compared with experimental data. C.R.S.Manders

539.153

634. SELF-CONSISTENT FOCK FIELD FOR THE EXCITED HELIUM ATOM. Ya.I.Vizbaraĭte, A.I.Kantserevichyus and A.P.Yutsis.
Optika i Spektrosk., Vol. 1, No. 1, 9-16 (1956). In Russian.

Equations of a Fock field have been solved for configurations 1s 2s, 1s 3s, 1s 3p and 1s 4p of the helium atom. Similar simplified Fock equations have been solved also for 1s 5p, 1s 6p, 1s 3d, 1s 4d, 1s 5d and 1s 6d configurations and from them values determined for the total energy of the helium atom. Determinations have been made of total energy values of a dipole arising in transitions between the ground and excited states of the helium atom and between the various excited states themselves. C.R.S.Manders

539.153

635. THE IONIZATION OF FAST NEUTRAL DEUTERIUM ATOMS. L.P.Chalklin and J.H.Fremlin.
Proc. Phys. Soc. A, Vol. 69, Pt 4, 356 (April, 1956).

Neutral deuterium atoms of 10 MeV energy from the Birmingham cyclotron were passed through a collimator and then through a thin Formvar foil. They were detected by a C2 emulsion and, from the fraction ionized, the cross-section for ionization in Formvar was found to be $2.4 \pm 0.4 \times 10^{-17}$ cm^2. J.H.Fremlin

539.155.1

636. MEASUREMENT OF THE MASS OF He^5. D.S.Craig, W.G.Cross and R.G.Jarvis.
Phys. Rev., Vol. 103, No. 5, 1427-9 (Sept. 1, 1956).

A Q value of 15.15 ± 0.04 MeV for the reaction $Li^6(t, \alpha)He^5$ has been obtained through a measurement of the energy of the alpha-particles. The mass of He^5 is then $5.013\,90 \pm 0.000\,04$ a.m.u. or $He^5 \rightarrow He^4 + n + 0.97 \pm 0.04$ MeV. The width of the ground state is 0.7 ± 0.2 MeV. A.

539.155.2

637. ISOTOPE SEPARATION BY THE PASSAGE OF AN [ELECTRIC] CURRENT THROUGH A MOLTEN METAL. P.G.de Gennes.
J. Phys. Radium, Vol. 17, No. 4, 4343-6 (April, 1956). In French.

The analysis of ion–electron collisions in a molten metal consisting of two isotopes shows that the ions of the lighter isotopes have a larger cross-section. In the presence of a current it is therefore entrained by the electrons. The quantitative determination of the separation requires the knowledge of the number of free electrons, the mean oscillation frequency of the ions and their constant of self-diffusion. Applied to gallium the calculated value is about 1/2 times the observed value (Abstr. 10433/1954). H.London

539.155.2 : 551.49 : 551.577

638. TRITIUM IN NATURE. W.F.Libby.
J. Washington Acad. Sci., Vol. 45, No. 10, 301-14 (Oct., 1955).

Measurements have been made on over 150 samples of water from many different locations leading to an average rate of tritium production by cosmic rays of 0.14 atoms per cm^2 per second over the earth's surface; accuracy is probably within 20%. Sea water at the surface contains tritium, and the values obtained suggest a mixing depth of about 100 metres only. Some data on the tritium content of individual rainstorms is discussed in terms of meteorology. It is shown that the age of well water and wine can be estimated provided it is less than 50 years old. J.M.Hough

539.155.2

639. THE ISOTOPIC EFFECT DUE TO ELECTROLYTIC TRANSPORT OF LEAD IONS IN MOLTEN LEAD CHLORIDE. A.Lundén, G.Horlitz and P.Signer.
Z. Naturforsch, Vol. 11a, No. 4, 280-3 (April, 1956). In German.

The heavy and light isotopes of lead were enriched by electrolysis of a series of salts, including molten lead chloride. The relative difference of the transport velocities of Pb^{206} and Pb^{208} amounted to 0.023% and the mass effect to −0.024. The relationship between the mass effect and the transport number is discussed. H.C.Cole

539.155.2

640. ISOTOPIC ENRICHMENT IN LITHIUM BY ELECTROLYTIC TRANSPORT IN MOLTEN LITHIUM BROMIDE. A.Lundén.
Z. Naturforsch., Vol. 11a, No. 7, 590-1 (July, 1956). In German.

The apparatus and experimental details are described. The observed mass effect of -0.26 ± 0.02 is twice as great as that previously found (Abstr. 3616/1947) in lithium chloride. W.Good

539.155.2

641. THE SEPARATION OF THE URANIUM ISOTOPES WITH THE SEPARATION JET. E.W.Becker and R.Schütte.
Z. Naturforsch, Vol. 11a, No. 8, 679-80 (Aug., 1956). In German.

The authors claim that their (Abstr. 9838/1955) isotope separation process, which depends on the partial spatial separation achieved in a jet stream, is of primary interest in the case of the uranium isotopes. It may provide a substitute for the diffusion separation process using porous membranes. The development work on the process was performed using heavy chemically inert gases. Experiments were performed using UF_6 in a single stage at a stripping ratio of about 4.5%. The average change in the natural U^{235} concentration was (1.3 ± 0.2)%. The results are compared with those obtained for CO_2 in the same apparatus. H.C.Cole

539.156 : 533.7

642. ENERGY OF INTERACTION BETWEEN A HYDROGEN ATOM AND A HELIUM ATOM. E.A.Mason, J.Ross and P.N.Schatz.
J. chem. Phys., Vol. 25, No. 4, 626-9 (Oct., 1956).

The potential energy of interaction between a hydrogen atom and a helium atom has been calculated as a function of separation distance by standard quantum mechanical variation procedures. The approximate molecular wave-functions used contained both homopolar and ionic contributions, and were constructed from 1s hydrogen-like atomic wave-functions. All integrals involved have been evaluated accurately. The results are in agreement with a potential determined from measurements of the scattering of high velocity hydrogen atoms in helium gas. For separation distances greater than 1 A, the results have been combined with an estimate of the potential of the London dispersion forces, and the combination has been represented by an exp-six potential useful in the calculation of properties of gases. A.

RADIOACTIVITY. α-, β- AND γ-RAYS

539.16

539.16.08

643. PURIFICATION OF CO_2 FOR USE IN A PROPORTIONAL COUNTER FOR ^{14}C AGE MEASUREMENTS. H. de Vries.
Appl. sci. Res. B, Vol. 5, No. 5, 387-400 (1956).

The permissible amounts of impurities in carbon dioxide, to be used in a proportional counter, are of the order of one part in a million. Several different steps of purification are necessary. The method used consisted of condensing vapours at −80° C, whereafter the CO_2 was frozen at −182° C and non-condensible gases pumped off. About 140 simple inorganic compounds can be left after this purification. It is shown that none of these will escape from the chemical traps, consisting of furnaces with copper and silver. Special attention is paid to the inert gases, of which radon is important because of its radioactivity. In an appendix it is shown that the maximum permissible rate of flow of a gas through a cold trap is about $10/a$ cm^3/sec, a being the temperature gradient along the tube. For higher rates of flow fog will be produced that passes through the trap. A.

539.16.08

644. THE ABSORPTION CURVES OF Ru^{103} AND Ru^{106}. A.W.Kenny and W.R.E.Maton.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 513, 6 pp. (1955).

The absorption in aluminium of the radiations from Ru^{103} and Ru^{106} has been measured in a windowless counter. The absorption curves are interpreted in terms of the reported radiations of these isotopes. A.

539.16.08

645. MEASUREMENT OF TRITIUM AS WATER VAPOR. R.W.P.Drever and A.Moljk.
Rev. sci. Instrum., Vol. 27, No. 8, 650-1 (Aug., 1956).

When assaying tritiated water vapour the most direct method is to introduce the water vapour as such in a methane-filled Geiger or proportional counter. The operation of the counter is then impaired because of electron attachment but no pulses will be lost if experimental conditions are right. However, during the counting there is a decrease of activity with time which is explained by adsorption of the source on the counter wall — the extent of this is difficult to assess and may introduce large errors. L.E.Mussell

539.163 : 537.533.35

646. STUDIES OF NUCLEAR DISINTEGRATIONS WITH A COINCIDENCE SPECTROMETER. T.R.Gerholm.
Ark. Fys., Vol. 11, Paper 2, 55-77 (1956).

A spectrometer for electron—electron and electron—gamma coincidence measurements is described. Attention is called to some of its applications, namely (i) the study of complex nuclear disintegration, (ii) determinations of internal conversion coefficients and branching ratios and (iii) measurements of the lifetimes of specified nuclear levels. The experimental difficulties and the limitations encountered are discussed in some detail. The instrument has been used for the study of the following isotopes: Pb^{200}, Pb^{205} and Tl^{200}. Finally, a new method is suggested for the measurement of very short-lived nuclear levels ($\leq 10^{-10}$ sec) with the aid of the electron—electron coincidence spectrometer and a high-frequency transmitter. A.

539.163

647. NUCLEAR ISOMERISM IN ODD LEAD ISOTOPES. R.Stockendal, J.A.McDonell, M.Schmorak and I.Bergström.
Ark. Fys., Vol. 11, Paper 7, 165-88 (1956).

In milking experiments the isomers of Pb^{199}, Pb^{201} and Pb^{203} were obtained from their corresponding bismuth parents. In Pb^{205} no isomeric transition was observed. The isomers were studied by means of scintillation spectrometers, double-focusing β-spectrometers, and a permanent magnet β-spectrometer for photographic recording. The following half-lives and transition energies were found: Pb^{199m}: $T_{1/2} = 13 \pm 1$ min, $E_\gamma = 410 \pm 30$ keV; Pb^{201m}: $T_{1/2} = 61 \pm 2$ sec, $E_\gamma = 629 \pm 1$ keV; Pb^{203m}: $T_{1/2} = 6.5 \pm 0.5$ sec, $E_\gamma = 825.2 \pm 0.5$ keV. The isomeric transitions were shown to be M4 transitions. Only one gamma-ray was found in each decay. Therefore $f_{5/2}$ ground states for Pb^{199}, Pb^{201} and Pb^{203} are suggested. Odd lead isomers were shown to exhibit a systematic trend in half-lives and energies. The matrix elements of the M4 transitions in the odd lead isomers were found to be remarkably constant. A.

539.163

648. THE PREPARATION AND PROPERTIES OF Pu^{242}. J.P.Butler, M.Lounsbury and J.S.Merritt.
Canad. J. Chem., Vol. 34, No. 3, 253-8 (March, 1956).

Three samples of plutonium rich in Pu^{242} and containing from 1.7 to 8.6% Pu^{238} have been prepared by the neutron irradiation of Am^{241}. From mass analyses and measurements of the alpha abundance of Pu^{242}, the alpha half-life of Pu^{242} was determined as $3.73 \pm 0.05 \times 10^5$ yr. The spontaneous fission half-life of Pu^{242} was also measured as $6.6_4 \pm 0.10 \times 10^{10}$ yr. A.

539.163

649. RADIOACTIVE ISOTOPES Cl^{40} AND Ga^{74}. H.Morinaga.
Phys. Rev., Vol. 103, No. 2, 504-5 (July 15, 1956).

Solid A was bombarded by fast neutrons and the resulting γ-rays of 1.46, 2.75 and 6.0 MeV of a product with a half-life of 1.4 min were assigned to Cl^{40}; this is also supported by chemical separation. The β-spectrum of Cl^{40} extended to 7.5 MeV with a strong component which has a 3.0-3.5 MeV end-point. Ga^{74} with a half-life of 8 min was obtained by bombarding pure Ge with fast neutrons; it emits γ-rays of 0.58, 2.3 and 2.6 MeV. Tentative decay schemes are suggested. A.O.Stanesby

539.163

650. A NEW TECHNETIUM ISOTOPE (Tc^{104}). J.Flegenheimer and W.Seelmann-Eggebert.
Z. Naturforsch., Vol. 11a, No. 8, 678 (Aug., 1956). In German.

By the bombardment of Ru with fast neutrons and the bombardment of U with 28 MeV deuterons a Tc^{104} isotope was produced with a half-life of 3.8 ± 0.2 min. The maximum energy of its β-radiation was about 2 MeV; and its γ-radiation over 1 MeV. A Tc isotope with a half-life of 18 min was also produced by the above method. The nuclear properties of these isotopes are discussed and the method of measuring them described. H.C.Cole

539.163

651. A NEW HAFNIUM-ISOTOPE (Hf^{183}). O.O.Gatti and J. Flegenheimer.
Z. Naturforsch., Vol. 11a, No. 8, 679 (Aug., 1956). In German.

By the irradiation of W and its compounds with fast neutrons from a synchrocyclotron, a new Hf isotope with a half-life of 64 ± 3 min was observed in the chemically separated Hf fraction. The maximum β-energy was about 1.4 MeV. The chemical separation of the Hf fraction from the W is described and the nuclear properties of the Hf^{183} are discussed. Ta^{184} the discovery of which was recently reported by Poë (Abstr. 3132/1956) was found in the Ta fraction. H.C.Cole

539.163.1

652. DISINTEGRATION OF Cs^{138}. M.E.Bunker, R.B.Duffield, J.P.Mize and J.W.Starner.
Phys. Rev., Vol. 103, No. 5, 1417-22 (Sept. 1, 1956).

The decay of the fission product Cs^{138} (32.1 minutes) has been studied with beta- and gamma-scintillation spectrometers and a 141 gauss, 180° permanent-magnet spectrograph. Twelve gamma-rays were found with energies of 0.1389, 0.1931, 0.2289, 0.4106, 0.4626, 0.550, 0.87, 1.010, 1.426, 2.21, 2.63 and 3.34 MeV. On the basis of coincidence measurements, intensity data, internal-conversion coefficients, angular correlation data, and the above gamma energies, a consistent decay scheme is proposed which involves levels in Ba^{138} at 1.426, 1.89, 2.21, 2.30, 2.44, 2.63 and 3.34 MeV. A.

539.163.1

653. WEAK BRANCHINGS IN THE DECAY OF P^{34}, Cl^{34}, AND P^{30}. H.Morinaga and E.Bleuler.
Phys. Rev., Vol. 103, No. 5, 1423-7 (Sept. 1, 1956).

The gamma-rays following the beta decays of P^{34}, Cl^{34}, and P^{30} were investigated with a NaI scintillation spectrometer and a twenty-channel analyser. An unsuccessful search was made for a gamma-ray with an energy of 3.22 MeV from P^{34} which should result from an allowed beta-decay branching to the second excited state in S^{34}. Since no such gamma-ray was found, this branching, if it exists, is very weak, with a log ft value higher than 5.6. Together with the known branching to the first excited state and the transition rates from the Cl^{34} 3^+ isomeric state, the above result suggests that the second excited state in S^{34} has a configuration similar to that of the Cl^{34} isomeric state and that the first excited state resembles the P^{34} ground state. For explaining the transition rate to the ground state from P^{34}, the assumption of strong mixing of both types in the S^{34} ground state seems to be necessary. This strong mixing in the 0^+ ground state also gives an explanation for the inversion of the order of the lowest T = 0 and T = 1 states of Cl^{34}. An additional state of S^{34} at 4 MeV, which is attained from both the P^{34} and the Cl^{34} 3^+ state and is thus to be interpreted as a 2^+ state, was found. In the case of P^{30} a beta-decay branching to the first excited state of Si^{30} was looked for. A weak gamma-ray of 2.24 MeV was found, indicating a branching 0.2% with a log ft of 5.4. A.

539.163.2

654. A NEW DETERMINATION OF THE SPECIFIC [α-] ACTIVITY OF RADIUM. W.Sebaoun.
Ann. Phys. (Paris), Sér. 13, Vol. 1, 680-718 (July-Aug., 1956). In French.

The value obtained was $(3.62 \pm 0.03) \times 10^{10}$ α-particles $sec^{-1} g^{-1}$, corresponding to a half-life of 1617 ± 12 yrs. A.O.Stanesby

539.163.2 : 539.185

655. NEUTRON EMISSION BY A SHORT-LIVED RADIOACTIVE RADIUM DEPOSIT. A.V.Kogan.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 817-19 (1956). In Russian.

Various processes which could give rise to the neutrons are discussed; the most probable appears to be emission by excited RaD formed in the β-decay of RaC". G.E.Brown

539.163.2

656. DISINTEGRATION SCHEME OF Ra^{226} (1620 YR).

G.Harbottle, M.McKeown and G.Scharff-Goldhaber.
Phys. Rev., Vol. 103, No. 6, 1776-7 (Sept. 15, 1956).

The excited states of Em^{222} were studied in connection with a survey of regularities in heavy even–even nuclei. Em^{222} was shown to have a second excited state of character 2+, 4+, or possibly 0+ at 448 keV. This result was obtained by confirming the existence of a weak γ-ray of 260 keV in the Ra^{226} spectrum, which had previously been observed by Stephens in coincidence with Ra^{226} α-rays. This γ-ray was found to be in coincidence with the well known 188 keV transition leading from the first excited state (2+) to the ground state. The intensity ratio $I_{\gamma 260} : I_{\gamma 188} = 1 : 400$. From this ratio and the known value of 5.7% for the α-branch feeding the 188 keV state, the intensity of the α-branch feeding the 448 keV state was found to be ~ 0.01%. A.

539.163.2

657. DECAY OF A^{41}. A.Schwarzschild, B.M.Rustad and C.S.Wu.
Phys. Rev., Vol. 103, No. 6, 1796-801 (Sept. 15, 1956).

The beta and gamma radiations from 110 min A^{41} were investigated with a 180° and a lens-type magnetic beta spectrometer and a NaI(Tl) scintillation spectrometer. Two beta groups are observed with end points of 2.48 ± 0.04 MeV and 1.99 ± 0.008 MeV with relative intensities of 0.88% and 99.1%, respectively. The beta spectrum of the upper energy group exhibits an α-shape in agreement with shell model predictions for the spins of the involved levels. The log f_1t of this transition is 8.50. The gamma-ray energy is 1.290 ± 0.005 MeV. This results in a mass difference of 2.489 ± 0.010 MeV between the ground states of A^{41} and K^{41}. A procedure is described for determining the background contribution in the region of the very weak, high-energy group due to the scattering of beta and gamma radiation. A.

539.164.08

658. USE OF Au-Ge BROAD AREA BARRIER AS ALPHA-PARTICLE SPECTROMETER. J.Mayer and B.Gossick.
Rev. sci. Instrum., Vol. 27, No. 6, 407-8 (June, 1956).

Good energy resolution and a linear pulse-height energy relationship is obtained when alpha-particles are detected by an Au–Ge surface barrier. Alpha-particles of energies up to 8.8 MeV were used. M.A.Grace

539.164.1

659. ON THE PROBABLE EXISTENCE OF UNKNOWN RADIOACTIVE BODIES EMITTING VERY SHORT RANGE α-PARTICLES. R.Coppens.
C.R. Acad. Sci. (Paris), Vol. 243, No. 6, 582-4 (Aug. 6, 1956). In French.

Very short range α-particles (3-4, 10 and 14 μ) were found in nuclear emulsions impregnated with certain solutions of iron salts. A.O.Stanesby

539.164.2

660. ALPHA DECAY OF SPHEROIDAL NUCLEI. J.O.Rasmussen and B.Segall.
Phys. Rev., Vol. 103, No. 5, 1298-1308 (Sept. 1, 1956).

The consequences of spheroidal deformation of nuclei on the barrier transmission in alpha decay are considered. A set of coupled differential equations is derived relating the amplitudes of the various groups of alpha-particles emitted from a nucleus described by the Bohr–Mottelson model. The cases of the decay of Th^{228} and Cm^{242} were studied numerically and from them information regarding the probability distribution of alpha-particles on the nuclear spheroidal surface is obtained. It is found that the one-body model of an alpha-particle in a well does not yield these distributions, and it is thus concluded that "alpha-particle clusters" have a short mean free path in nuclear matter. The shift in the surface distributions of Th^{228} and Cm^{242} may be explained qualitatively in terms of the order of nucleon orbital filling. The over-all penetration factors for the spheroidal case are compared with those for the spherical case, and it is found that the resultant enhancement due to the deformation is not nearly as large as that predicted by Hill and Wheeler on the basis of a one-dimensional approximation. A.

539.165 : 539.166

661. ON THE COLOUMB EFFECT FOR THE INTERNAL BREMSSTRAHLUNG ACCOMPANYING BETA DECAY. S.B.Nilsson.
Ark. Fys., Vol. 10, Paper 34, 467-77 (1956).

Reference is made to the elementary picture of the radiative beta-decay due to Knipp and Uhlenbeck, and to the modifications of the Born-approximation formula suggested by this picture to include the Coulomb effect. The main part of the paper is devoted to a more consistent theoretical treatment of allowed transitions, in which the Coulomb field is taken into consideration from the outset and not only in the end result. The calculation reported here is still approximate in considering only that contribution to the Coulomb effect which comes from the proper beta transition. A numerical integration in the case of S^{35} shows a not inconsiderable increase over the photon yield predicted by the elementary picture in the corresponding approximation (which is commonly employed to compare with experiment). However, in this approximation at least, the increase is not large enough to account for the very high yield observed in some recent experimental work. A.

539.165

662. ANALYSIS OF THE BETA SPECTRUM AND BRANCHING IN Ho^{166}. G.Alaga and B.Jakšić.
Phys. Rev., Vol. 103, No. 5, 1441-2 (Sept. 1, 1956).

The shape of the β spectrum of the $Ho^{166} \rightarrow Er^{166}$ ground state (0– → 0+) transition and the branching to the first excited state (2+) has been investigated. Corrections due to the variation of the lepton wave functions over the nucleus have also been taken into account, and it is shown that under certain conditions these corrections can be sufficient to explain the experimental findings. A.

539.165.2

663. BETA DECAY OF A C^9 NUCLEUS. M.S.Swami, J.Schneps and W.F.Fry.
Phys. Rev., Vol. 103, No. 4, 1134-5 (Aug. 15, 1956).

In a systematic search for excited nuclear fragments from disintegrations caused by 3 BeV protons in nuclear emulsions, a track has been found and interpreted as being due to a C^9 nucleus; hitherto there has been no evidence for a long lived C^9 nucleus. The secondary star consisted of four charged particles; one is identified as an electron by scattering v. grain-density measurements, the energy being 3.1 MeV. The other tracks are coplanar and this together with momentum balance suffices to identify the particles as a proton and two α-particles. The decay scheme suggested is, $C^9 \rightarrow Be^{8*} + p + \nu + \beta^+$, $Be^{8*} \rightarrow 2He^4$. D.J.A.Prowse

539.166

664. γ-RADIATION FROM THE DISINTEGRATION OF $_{51}Sb^{127}$. H.Bosch and H.Munczek.
Cienc. e Invest., Vol. 12, No. 6, 244-8 (June, 1956). In Spanish.

This was studied by means of a scintillation spectrometer. A detail of the contribution of Compton background is given. The intensities and periods of the photopeaks have been determined taking into account the contribution of Compton background. A new half-life of 149 ± 4 hours was found. A.

539.166

665. MILLIGRAMME Ra-EQUIVALENTS OF SOME γ-EMITTING RADIOELEMENTS. S.Vuccino and J.Tobailem.
J. Phys. Radium, Vol. 17, No. 4, 347-9 (April, 1956). In French.

These were determined for Co^{60}, Cs^{137}, Sc^{46}, Na^{24} and Cu^{64} for two different ionization chambers, and using two different methods of obtaining the absolute intensities. A curve of the efficiency (ρ = ionization current/no. of γ-quanta absorbed per sec) of the ionization chambers as a function of the γ-energy is given. A.O.Stanesby

539.166 : 537.531 : 535.33

666. THE USE OF SCINTILLATION SPECTROMETERS IN THE STUDY OF CONTINUOUS GAMMA AND X-RAY SPECTRA BETWEEN 0.01 AND 20 MeV. N.Starfelt.
K. Fysiogr. Sällsk. Lund, Förhandl., Vol. 26, Paper 5, 23 pp. (1956).

The study of nuclear and external bremsstrahlung yields information about the properties of nuclei and the validity of methods in quantum electrodynamics, while knowledge of the bremsstrahlung spectra from electron accelerators is required in the study of photonuclear reactions and the scattering of photons by nuclei. Scintillation spectrometers, with their high detection efficiency for gamma-rays and the possibility of correcting for their comparatively poor energy resolution, permit the accurate investigation of continuous spectra. The processes in the scintillator giving rise to the pulse height spectrum, and the effect of crystal material and size are

reviewed. In order to calculate the continuous spectrum entering the crystal from the resulting pulse height distribution from the photomultiplier, it is necessary to obtain, by experiment or calculation, the response function of the spectrometer for single gamma-ray lines over the range. Methods of doing this are described, and the procedure for calculating the form of the incident continuous spectrum is discussed. An accuracy in spectral shape of ±5% is possible. D.R.Chick

539.166

667. γ-RAYS FROM THE DECAY OF Zr^{97}. R.Nordhagen and J.Thomassen.
Nuclear Physics, Vol. 1, No. 7, 499-500 (1956).

The γ-ray spectrum was examined using a NaI(Tl) scintillation spectrometer. A tentative decay-scheme for $Zr^{97} \rightarrow Nb^{97} \rightarrow Mo^{97}$ is put forward. A.O.Stanesby

539.166 : 539.152.1

668. GAMMA-RAY BRANCHING RATIO OF THE 3.95 MeV LEVEL IN N^{14}. H.E.Gove, A.E.Litherland, E.Almqvist and D.A.Bromley.
Phys. Rev., Vol. 103, No. 3, 835-7 (Aug. 1, 1956).

A 4.3 ± 0.8% cross-over transition from the 3.95 MeV level has been established by detection of the γ-rays in coincidence with protons from the $C^{12}(He^3, p)N^{14}$ reaction. The angular distributions of the 1.64 and 2.31 MeV cascade γ-rays are consistent with 0^+ and 1^+ assignments to the 2.31 and 3.95 MeV levels. J.J.Wilkins

539.166

669. THE DISINTEGRATION ENERGY OF ^{51}Cr. J.B.van der Kooi and H.J.van den Bold.
Physica, Vol. 22, No. 8, 681-2 (Aug., 1956).

The internal bremsstrahlung spectrum was investigated using a NaI(Tl) γ-scintillation spectrometer; the end-point was 746 ± 22 keV giving a value of 752 ± 22 keV for the Cr^{51}–V^{51} mass difference. A.O.Stanesby

539.166.08 : 537.542

670. COMPTON BACKSCATTERED PHOTONS IN PRECISION PROPORTIONAL COUNTER SPECTROMETRY. R.W.Fink and B.L.Robinson.
Rev. sci. Instrum., Vol. 27, No. 9, 712-13 (Sept., 1956).

The importance of Compton backscattering in gas proportional spectrometry in the energy range 10 to 100 keV is pointed out. If the backscattered photons are unresolved from the main peak, a large error may be introduced under certain conditions in absolute and relative intensity measurements based on theoretical quantum efficiency (geometry x absorption); if the backscattered peak is resolved, failure to recognize its origin may result in the "discovery" of a new gamma-ray. The effect is especially pronounced when a collimator is used to establish geometry; for example, the intensity of backscattered photons can amount to as much as half the intensity of the main peak at 46.5 keV with a $\frac{1}{4}$-in. diameter collimator. A.

539.166.08 : 537.531.08

PHOTOGRAPHIC BADGES FOR THE ESTIMATION OF THE QUALITY OF X AND GAMMA RADIATION. See Abstr. 442

539.166.2

671. A SEARCH FOR THE EMISSION OF HIGH ENERGY γ-RADIATION FROM A PREPARATION OF Ac^{227}. J.F.Turner.
Atomic Energy Res. Establ. (Harwell) Rep. No. NP/R 1982, 6 pp. (1956).

The γ-ray emission of a preparation of Ac^{227} has been studied by observation of the secondary electron spectrum ejected from a Pb radiator, in a thin lens β-spectrometer with a proportional scintillation detector. Evidence for very low intensity γ-rays of energy ~ 1.8, 2.5 and 3.5 MeV has been obtained, the time dependence of their intensities giving some guidance in their allocation. Evidence for a previously unreported γ-ray of energy 1.11 MeV has also been obtained. A.

539.166.2 : 539.172.13

672. ANGULAR DISTRIBUTION OF 16.1 MeV GAMMA RAYS FROM THE 163 keV RESONANCE IN THE REACTION $B^{11}(p, \gamma)C^{12}$. D.S.Craig, W.G.Cross and R.G.Jarvis.
Phys. Rev., Vol. 103, No. 5, 1414-16 (Sept. 1, 1956).

The relative thick-target yield, at a bombarding energy of 168 keV, of 16.1 MeV gamma-rays from the reaction $B^{11}(p, \gamma)C^{12}$ has been measured at 0, 60, 90 and 120 degrees. The angular distribution is of the form $1 - A\cos\theta + B\cos^2\theta$, with A = 0.19 ± 0.06 and B - A = 0.02 ± 0.04. The $\cos\theta$ term is believed to be caused by interference between a resonance of spin and parity 1– at a bombarding energy of 1.4 MeV, and the resonance of spin and parity 2^+ at a bombarding energy of 163 keV. A.

539.166.75 : 537.531

673. ABSORPTION IN DIFFERENT TISSUES OF COBALT 60 GAMMA RADIATION AND ROENTGEN RAYS WITH HALF-VALUE LAYERS FROM 1 mm Al TO 5 mm Cu. L.E.Jacobson and I.Knauer.
Radiology, Vol. 66, No. 1, 70-83 (Jan., 1956).

The absorption of four different radiation qualities in muscle, fat, lung, compact bone and spongy bone of beef has been measured for three typical field sizes. The values of absorption coefficient and the calculated depth-dose curves agree with earlier values (Abstr. 9881/1951). For Co^{60} radiation, the depth-dose calculated at the lungs in a typical body cross-section was 17% greater than that predicted from accepted depth-dose curves; the discrepancy has been verified experimentally with phantom measurements and arises from low absorption in lung tissue. J.R.Mallard

539.166.83

674. ON THE THEORY OF [INTERNAL] CONVERSION COEFFICIENTS. G.Kramer.
Z. Phys., Vol. 146, No. 2, 187-204 (1956). In German.

Internal conversion coefficients are derived on the assumption of (a) a point nucleus, and (b) a finite nucleus. The so-called "gauge paradox" (apparent dependence of conversion coefficients on choice of gauge) is resolved. For internal conversion of K-electrons by a magnetic dipole transition the error introduced by the assumption of a point nucleus is at most 40%. J.W.Gardner

539.166.835

675. ON THE ANNIHILATION OF POSITRONS IN CONDENSED MATERIALS. T.R.Gerholm.
Ark. Fys., Vol. 10, Paper 38, 523-32 (1956).

The positron annihilation lifetimes in various metals and insulators have been measured with an automatic millimicrosecond coincidence equipment. The lifetimes were found to be the same in all metals and equal to $(2.5 \pm 0.3) \times 10^{-10}$ sec, which is longer than the value hitherto accepted, $(1.5 \pm 0.3) \times 10^{-10}$ sec. The halflife of the first excited state in Pb^{207} was found to be $(0.9 \pm 0.3) \times 10^{-10}$ sec. This result is in accordance with the value $1.0^{+0.4}_{-0.2} \times 10^{-10}$ sec deduced for this halflife from the reduced transition probabilities measured in Coulomb excitation. The annihilation lifetimes in various metals and insulators are in agreement with the theoretical values deduced from a model suggested here. A weak component with a longer lifetime has been observed in aluminium. An interpretation of this component is suggested, based on the same model. A.

539.166.835 : 537.542

676. TWO CHANNEL HOMOGENEOUS FIELD AXIAL FOCUSING PAIR SPECTROMETER. J.A.Jungerman.
Rev. sci. Instrum., Vol. 27, No. 5, 322 (May, 1956).

The ring focus property of an axially symmetric field results in an increased counting rate. The paper describes a means of further improving the counting rate by the use of multiple channels from source to detector. For favourable source geometry and random pair emission, the improvement is better than the square of the number of channels. Following the method suggested by Hubert, a two-channel instrument, using three diaphragms, is described. The two-channels have the same momentum width. Particles are detected on separate scintillators feeding concentric light pipes which are divided axially for statistical counting. D.R.Chick

539.166.9

677. EXPERIMENTALLY DETERMINED ELECTRON ENERGY DISTRIBUTION PRODUCED BY COBALT 60 GAMMA RAYS. W.R.Bruce and H.E.Johns.
Brit. J. Radiol., Vol. 28, 443-5 (Aug., 1956).

A scintillation spectrometer with an anthracene phosphor was used to determine the electron energy distribution of Co^{60} gamma radiation in water at 2 cm to 30 cm depth. The field size of the beam was varied from 5 x 5 cm^2 to 15 x 15 cm^2. The conclusion is drawn that the rate at which the electrons lose their energy does not change greatly with depth or area. M.Ebert

539.166.9 : 539.18 : 539.172

PRODUCTION OF π-MESON PAIRS BY γ-RAYS. See Abstr. 684

539.167.3

678. THE SOLVENT EXTRACTION OF PROTACTINIUM. A.Goble, J.Golden and A.G.Maddock.
Canad. J. Chem., Vol. 34, No. 3, 284-92 (March, 1956).

The variation of the experimental extraction coefficient for protactinium upon dilution of the solvent ketone with benzene has been determined for aqueous solutions at constant concentration of hydrochloric acid. The bromo complex has been shown to be far less readily extracted. The effects on the extraction of the nitrate complex by amyl acetate, of the nitric acid, of the nitrate and hydrogen ion concentrations in the aqueous phase, as well as of the dilution of the solvent with benzene, have been explored. The existence of a slow reaction in the extraction has been demonstrated. It is concluded that chloride solutions are the more reliable for the isolation of protactinium from concentrates. A.

NUCLEAR REACTIONS 539.17

539.172 : 537.542

679. LOW PRESSURE DIFFUSION CLOUD CHAMBER TRACKS OF FRAGMENTS FROM THE SPONTANEOUS FISSION OF CALIFORNIUM 252. I. H.Slätis.
Ark. Fys., Vol. 10, Paper 35, 497-88 (1956).

The development of the diffusion cloud chamber is briefly given. A diffusion cloud chamber for demonstration purposes and a low-pressure diffusion chamber have been constructed. Tracks of α-particles and fission fragments from californium 252 and electrons and protons are shown, the first two types of tracks at a pressure of 0.2 atmospheres. A.

539.172

680. HYDRODYNAMICAL THEORY OF THE MULTIPLE PRODUCTION OF PARTICLES IN HIGH ENERGY NUCLEON–NUCLEUS COLLISION. C.Iso and M.Sato.
Progr. theor. Phys., Vol.15, No. 5, 510-12 (May, 1956).

The Landau theory has been applied to the collision of a nucleon with a light nucleus. Details of calculations follow in a later paper. The following predictions have been derived in the equi-velocity system for $n < \sim 3.7$ ($n \cong$ number of nucleons in the tube of nuclear matter involved in the collision): (1) forward energy/backward energy = $1/n$; (2) most of the emitted particles are slow (energy $\cong$ rest-mass) and equal numbers of particles are emitted forwards and backwards; (3) the faster particles are emitted in the forward and backward directions with ratio $1/n$. The angular distribution in the laboratory system is sharper than that predicted by the Fermi model. R.H.W.Johnston

539.172

NUCLEAR REACTIONS DUE TO COSMIC RAYS. See also under "Cosmic rays". Decimal classification 537.591.8

539.172

681. ON THE VALIDITY OF THE WILLIAMS–WEIZSÄCKER METHOD AND THE PROBLEM OF THE NUCLEAR INTERACTIONS OF RELATIVISTIC μ-MESONS. D.Kessler and P.Kessler.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 601-9 (Sept., 1956).

After discussing arguments which have been put forward against the application of the semi-classical Williams–Weizsäcker method to the problem of the nuclear interactions of relativistic μ-mesons, a new treatment consistent with quantum field theory is developed. The results agree with Williams and Weizsäcker's, in the sense that the μ-meson and photon cross-sections can be compared for corresponding processes by means of an "equivalent photon spectrum", almost the same in both theories. It is shown that in these non-elastic photonuclear processes the angular deviation of the μ-meson is not uniquely related to primary energy and energy-transfer. It is in most cases of practical interest much smaller than in the elastic Coulomb scattering. A.

539.172 : 539.18

682. CAPTURE OF K^- MESONS BY NUCLEI. D.M.Haskin, T.Bowen and M.Schein.
Phys. Rev., Vol. 103, No. 5, 1512-18 (Sept. 1, 1956).

Seventy events of K^- capture at rest have been analysed in emulsion stacks exposed to the Berkeley Bevatron. The distribution of prong numbers and energy release of stars is given. The average prong number was 3.3 and the maximum prong number was 10. The small average energy release was found to be consistent with the assumption that in many events a large fraction of the K^- rest energy is carried away by neutral particles. The energy distribution of emitted nucleons was found to include energies up to 200 MeV. The energy distribution of emitted pions falls into two groups, one with a sharp upper limit corresponding to the expected pion energy of Σ-hyperon reactions and the other corresponding to Λ^0-hyperon reactions. The energy release in $\Sigma\pi$ events was found to be consistent with the assumption that the capture process takes place on bound nucleons. A small difference in the energy release of $\Sigma^+\pi^-$ compared with $\Sigma^-\pi^+$ events was found, indicating a possible mass difference $M(\Sigma^-) > M(\Sigma^+)$. An estimate of the ratio of production of Σ to Λ^0 hyperons, based on pion energies, gave Σ/Λ^0 about 2. The ratio Σ^-/Σ^+ was found to be $\geq 7/3$. The emission of pions with energies of more than 100 MeV was found, providing evidence for the direct production of Λ^0 hyperons. Hyperfragments were observed in four events. In one event two fast particles of nucleonic mass were emitted, one of them disappearing in flight, providing evidence for the existence of two-nucleon reactions. A.

539.172 : 539.18

683. ON THE PROBABILITY OF FISSION OF THE URANIUM ATOM UPON CAPTURE OF SLOW π^--MESONS. O.V.Lozhkin and V.P.Shamov.
Zh. éksper. teor. Fiz., Vol. 28, No. 6, 739-40 (1955). In Russian.

Methods similar to those of Perfilov and Ivanova (Abstr. 9067/1955) were used. After separation of the melted emulsion by a centrifuge, it was found that the uranium solution was not adsorbed by the AgBr crystals, but contained wholly in the gelatin. Hence, only π^- mesons stopping in the latter are considered. Capture by the gelatin is separated off by considering capture probability proportional to Z. Probabilities of fission in two experiments are 0.25 ± 0.05 and 0.33 ± 0.08. G.E.Brown

539.172 : 539.166.9 : 539.18

684. EXCITATION OF NUCLEAR STARS BY γ-RAYS. Yu.A.Vdovin.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 955-7 (1956). In Russian.

The process is considered in which a γ-ray produces a π-meson pair far from the nucleus and the pair is then absorbed by the nucleus with star production. See Abstr. 7688/1956 for the related process in which just one π-meson is absorbed. G.E.Brown

539.172

685. INTERACTION OF 4.5 BeV π^--MESONS WITH PROTONS. A.I.Nikishov.
Zh. éksper. teor. Fiz., Vol. 30, No. 5, 990-1 (1956). In Russian.

Calculations of the various end products are carried out using Fermi's statistical theory both with and without the isobar state and are compared with experiment. G.E.Brown

539.172.1

686. PRODUCTION OF TRANSURANIUM ELEMENTS BY HEAVY ION BOMBARDMENT. I. RAPID CHEMICAL TECHNIQUES FOR ISOLATING ACTINIDE ELEMENTS FROM BOMBARDED URANIUM TARGETS. J.Milsted, A.B.Beadle, K.M.Glover and J.H.Fremlin.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 1951, 11 pp. (1956).

In connection with the heavy ion bombardment programme at Birmingham University, chemical methods have been developed by which higher transuranium elements can be isolated from a bombarded uranium foil in about 30 minutes. The foil is dissolved in a hydrochloric acid–hydrogen peroxide mixture, and uranium is removed by anion exchange. A new type of microevaporator is used to speed up the evaporation of the solution, and the actinides are finally separated by complexing elution from a cation exchange column. A comparison of three α-hydroxy acids, glycollic, lactic and α-hydroxy isobutyric, as eluting agents has shown that the latter acid gives much greater separation factors than the other two. A.

539.172.11 : 537.591

687. ON THE HIGH ENERGY NUCLEAR COLLISION OF α-PARTICLES OF THE COSMIC RADIATION. W.Winkler.
Helv. phys. Acta, Vol. 29, No. 3, 267-80 (1956). In German.

34 of these stars found in emulsions exposed at 30 km height have been examined taking into account both black and grey tracks. Tables are given of the energy of the primary particles, calculated from the angular distribution of the shower particles, and of the meson velocities. The anisotropy is about 0.61 for all stars. The multiplicity is examined.

E.W.Kellermann

539.172.11 : 539.172.13

688. COULOMB EXCITATION OF ELEMENTS OF MEDIUM AND HEAVY MASS. R.H.Davis, A.S.Divatia, D.A.Lind and R.D.Moffat.
Phys. Rev., Vol. 103, No. 6, 1801-11 (Sept. 15, 1956).

Yields of gamma-rays from thick targets of In, I^{127}, Ta^{181}, $Re^{185,187}$, $Ir^{191,193}$, $Hg^{198,199,200,202}$, Th and U were investigated under proton or alpha-particle bombardment in the energy range 2 to 4 MeV. By using the theory for electric excitation, reduced matrix elements for all electrically excited radiations were computed and compared with single-particle estimates. The results are interpreted in terms of the strong-coupling collective model of Bohr and Mottelson and compared with the systematic trends in the region of the closed shell at 126 neutrons. A 512 keV gamma-ray excited in In by proton bombardment must result from a nuclear reaction. From excitation curves, gamma-rays in In^{127} at 60, 208, 392, 438, 631, 751 and 941 keV appear to arise from Coulomb excitation. No cascade radiations are observed. The radiations from Ta, Re, Ir and Hg show the effects of a transition from the strong collective rotational motion to a collective vibrational nuclear motion or single-particle excitation as one approaches the closed neutron shell. Only the first excited states of Th^{232} and U^{238} were excited with alpha particles. No evidence for other levels was observed with proton excitation. The results agree within experimental error with other excitation measurements and with radiative lifetime measurements. A.

539.172.13 : 539.172.4

689. FORMAL THEORY OF NUCLEAR DIRECT INTERACTION IN NUCLEAR SCATTERING. H.Ui.
Progr. theor. Phys., Vol. 14, No. 1, 75-6 (July, 1955).

The formal theory of the scattering of nucleons by complex nuclei has been extended to include the quasi-elastic scattering which arises from direct interactions with the individual nucleons in the nucleus. A complex potential well has been used. D.J.A.Prowse

539.172.13

690. TYPES OF REACTION OF 0.95 GeV PROTONS WITH THE LIGHT AND HEAVY NUCLEI OF THE PHOTOGRAPHIC EMULSION. G.Philbert.
C.R. Acad. Sci. (Paris), Vol. 243, No. 2, 141-3 (July 9, 1956). In French.

A comparison has been made of the results obtained in scanning normal and diluted emulsions, both exposed to a beam of 0.95 GeV protons. The partial probabilities for reaction with emission of 'n' particles have been calculated. The variation of these probabilities as a function of 'n' is very different for the heavy and light nuclei. D.J.A.Prowse

539.172.13 : 539.18

691. THE REACTION $p + p \rightarrow d + \pi^+$ AT 460 MeV.
M.G.Meshcheryakov, B.S.Neganov, N.P.Bogachev and V.M.Sidorov.
Dokl. Akad. Nauk SSSR, Vol. 100, No. 4, 673-6 (1955). In Russian

This reaction, which was investigated in a synchrocyclotron, was identified by means of two conjugated telescopes tuned for coincidences between π^+-mesons and deuterons. It was found that the efficiency of recording this reaction was 0.73 ± 0.04. The complete cross-section of this reaction, as integrated from the angular distribution of the mesons, was $(15.4 \pm 1.6) \times 10^{-28}$ cm^2. The experimental values obtained in this paper and in other papers (Abstr. 8962/1951, 521,558/1952 and 1909/1953) show that the cross-section of the reaction varies as T^n, where T is the meson energy in the mass-centre system, and n is between 3/2 and 2. The angular distribution obtained in this research points to the generation of the mesons predominantly, if not exclusively, in the p state. F.Lachman

539.172.13 : 539.18

692. MESON FORMATION IN THE REACTION $p + p \rightarrow d + \pi^+$ IN THE RANGE 510-660 MeV.
M.G.Meshcheryakov and B.S.Neganov.
Dokl. Akad. Nauk SSSR, Vol. 100, No. 4, 677-9 (1955). In Russian.

The complete section of this reaction at the higher energy value was calculated to be $(3.1 \pm 0.2) \times 10^{-27}$ cm^2 from the angular distribution of π^+-mesons, which was found to differ but little from that obtained in the preceding paper (see preceding abstract). Further calculations show, that while in the range 460-600 MeV the cross-section continues to increase rapidly, it remains nearly unchanged above 600 MeV. The mesons are also here generated predominantly in the p state.

F.Lachman

539.172.13

693. ELASTIC SMALL-ANGLE PROTON–PROTON SCATTERING AT 460, 560 AND 660 MeV. N.P.Bogachev.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 806-8 (1956). In Russian.

Fairly accurate measurements are carried out down to 5^0 (centre of mass system), and the results are given in a table. Scattered protons are detected by a telescope of scintillation counters. Total elastic and inelastic cross-sections are measured, as well as the total cross-section for the process $p + p \rightarrow n + p + \pi^+$. G.E.Brown

539.172.13

694. THE ANGULAR DISTRIBUTION OF α-PARTICLES FROM THE REACTION $^{19}F(p\alpha)^{16}O^*(\pi)^{16}O$. A.Isoya, K.Goto and T.Momota.
J. Phys. Soc. Japan., Vol. 11, No. 9, 899-906 (Sept., 1956).

The angular distribution of α-particles from the reaction $F^{19}(p\alpha)O^{16*}(\pi)^{16}O$ has been measured at fourteen energies between 800 keV and 1400 keV. The α-particles were detected and identified by coincidence with nuclear pair-electrons. The data were analysed to give coefficients in the expansion formula $\sigma(\theta) = a_0 + a_1 \cos\theta + a_2 \cos^2\theta + a_3 \cos^3\theta + a_4 \cos^4\theta$. The spins of the levels of the compound nucleus Ne^{20} were assigned from the evidence of anomalies in the coefficients. For the resonances at 843, 1126, 1355 keV J = 2 and for that at 1250 keV J = 1. A.

539.172.13 : 778.34

695. A TEST FOR THE "MEDIAN ANGLE" METHOD.
U.Haber-Schaim.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 669-70 (Sept., 1956).

The "median angle" method for the determination of the energy of particles producing stars in photographic emulsions is checked by applying the method to the stars produced by 6.2 GeV protons from the Berkeley bevatron. It is concluded that energy determination are subject to very large fluctuations, and that the derived value for energy is likely to be too large rather than too small. P.Rothwell

539.172.13

696. INELASTIC SCATTERING OF PROTONS FROM ISOTOPES OF Sc, Mn, Fe, Ni, AND Cu. P.M.Windham, C.R. Gossett, G.C.Phillips and J.P.Schiffer.
Phys. Rev., Vol. 103, No. 5, 1321-5 (Sept. 1, 1956).

The inelastic scattering of protons from eight nuclides has been studied using a precision 180^0 magnetic spectrometer. Energy levels in these nuclides were obtained to about 1.6 MeV of excitation. Proton energies of 4.4 to 5.7 MeV were used from a Van de Graaff accelerator. Cross-sections for the inelastic scattering processes were obtained. A.

539.172.13 : 539.18

697. p–p INTERACTIONS AT 3 BeV. R.Cester, T.F.Hoang and A.Kernan.
Phys. Rev., Vol. 103, No. 5, 1443-9 (Sept. 1, 1956).

Interactions initiated by 3 BeV protons of the Brookhaven Cosmotron were studied by photoemulsion technique. With appropriate criteria, 115 events are attributed to interactions of the incident beam protons with hydrogen nuclei (~ 55%) and with bound protons of other nuclei (~ 45%). A detailed analysis allowed the subdivision of the 115 events in categories, according to the number of π mesons ($N \geq 0$) produced in the collision. The ratio of elastic scattering to the total number of events was estimated to be $\sigma_{el}/\sigma_{total} = 0.20^{+0.04}_{-0.07}$. The observed cross-section for pure elastic scattering is $\sigma_{el} = 8.9 \pm 1.0$ mb. The percentages of single, double, triple and quadruple π-meson production are respectively: 34^{+22}_{-20}; 35.6^{+20}_{-23}; 9.6^{+6}_{-4};

$\sim 1.0^{+3.8}$. Among the 20 most probable cases of single π-meson production the estimated ratio of π^+ to π^0 is $\sigma_{\pi^+}/\sigma_{\pi^0} = 5.3^{+0.3}_{-1.4}$. The experimental results are not in agreement with the Fermi statistical-model theory (in particular the lower limit for the experimental ratio of triple to single production is given by $\sigma_3/\sigma_1 > \sim 1/10$ in contrast with the predicted ratio $\sigma_3/\sigma_1 = 1/67$) but are not inconsistent with the Peaslee excited-state-model theory. A.

539.172.13 : 539.18

698. PROTON–PROTON INTERACTIONS AT 810 MeV. T.W.Morris, E.C.Fowler and J.D.Garrison.
Phys. Rev., Vol. 103, No. 5, 1472-8 (Sept. 1, 1956).

244 examples of proton–proton scattering have been observed by using the hydrogen-filled diffusion cloud chamber of the Brookhaven cloud chamber group. The mean energy of the incident protons was measured to be 810 ± 100 MeV. The reactions observed were (1) $p + p \rightarrow p + p$, 126 examples, (2) $p + p \rightarrow p + n + \pi^+$, 84 examples, (3) $p + p \rightarrow d + \pi^+$, 1 example, and (4) $p + p \rightarrow p + p + \pi^0$, 5 examples, with 28 examples which can be either reaction (2) or (4). The total proton–proton cross-section was determined to be 45 ± 6 mb. The ratio R of the cross-section for π^+ production to that for π^0 production is 17 ± 8. An elastic differential distribution strongly peaked in the forward direction was obtained. Angle and momentum distributions of particles and angular correlations between pairs of particles from reaction (2) are presented. No interactions leading to the production of more than one meson or of heavy unstable particles were identified. A.

539.172.13 : 539.18

699. PROTON–PROTON INTERACTIONS AT 1.5 BeV. W.B.Fowler, R.P.Shutt, A.M.Thorndike and W.L.Whittemore.
Phys. Rev., Vol. 103, No. 5, 1478-83 (Sept. 1, 1956).

152 interactions of 1.5 BeV protons have been observed in a hydrogen-filled diffusion cloud chamber. The data indicate an elastic cross-section of 20 millibarns, with about 22 millibarns cross-section for single pion production and 5 millibarns for double pion production. Most single pion production cases are $p + p \rightarrow p + n + \pi^+$; no definite cases of $\rightarrow d + \pi^+$ or $\rightarrow p + p + \pi^0$ were observed. The median elastic scattering angle is 24° in the c.m. system. Inelastic events have pions emitted isotropically with low momenta, nucleons emitted near 0° and 180° with high momenta. The average relative energy (Q value) for the p, π^+ pair is 154 MeV. A.

539.172.13 : 539.18

700. PROTON–PROTON INTERACTIONS AT 2.75 BeV. M.M.Block, E.M.Harth, V.T.Cocconi, E.Hart, W.B.Fowler, R.P.Shutt, A.M.Thorndike and W.L.Whittemore.
Phys. Rev., Vol. 103, No. 5, 1483-9 (Sept. 1, 1956).

212 interactions of 2.75 BeV protons have been observed in a hydrogen-filled diffusion cloud chamber. The data indicate an elastic cross-section of 15 millibarns, with about 9 millibarns cross-section for single pion production, 13 millibarns for double, and 4 for triple. There is one example of quadrupole pion production. One definite example of the production of heavy unstable particles was observed, and two doubtful cases. The median elastic scattering angle was 19° in the c.m. system. Angle and momentum distributions for inelastic events are consistent with those observed at lower energies. A.

539.172.13 : 539.18

701. INTERPRETATION OF PROTON–PROTON INTERACTIONS AT COSMOTRON ENERGIES. W.B.Fowler, R.P.Shutt, A.M.Thorndike, W.L.Whittemore, V.T.Cocconi, E.Hart, M.M.Blocks, E.M.Harth, E.C.Fowler, J.D.Garrison and T.W.Morris.
Phys. Rev., Vol. 103, No. 5, 1489-1501 (Sept. 1, 1956).

In the absence of numerical predictions based on meson field theory, elastic p–p interactions have been compared with a simple optical model and inelastic ones with statistical theories and considerations based on charge independence. Elastic scattering data are fitted satisfactorily by a spherical interaction region with uniform density, radius 0.93×10^{-13} cm and absorption coefficient from 4.3 to 2.7×10^{13} cm^{-1}. Inelastic interactions provide a confirmatory test of charge independence at 0.81 BeV. Pion multiplicities at 1.5 and 2.75 BeV are higher than predicted by the Fermi statistical theory, but the difference is less than that observed for n–p interactions. The multiplicities observed for p–p interactions are lower than those calculated by Kovacs. Distributions of angle and momentum of particles, and correlation angle and Q-values for pairs of particles, in general agree with the predictions of statistical theory at 0.81 BeV and disagree at 1.5 BeV. The data that are not consistent with statistical predictions suggest that a π–nucleon interaction may affect pion production in an important way, but the data are not sufficiently accurate for definite conclusions. A.

539.172.13

702. AN INVESTIGATION OF THE γ-RAYS FROM THE REACTIONS $^{24}Mg(p, \gamma)\ ^{25}Al$ AND $^{12}C(p, \gamma)\ ^{13}N$, WITH A NOTE ON THE POSITRON DISINTEGRATION OF ^{25}Al. D.R.Chick, W.W.Evans, D.A.Hancock, S.E.Hunt and R.A.Pope.
Proc. Phys. Soc. A, Vol. 69, Pt 8, 624-7 (Aug., 1956).

C^{12} and Mg^{24} targets were irradiated by protons of energy 456.8 keV and 225.5 keV corresponding to the formation of excited levels in N^{13} and Al^{25} of energy 2.37 and 2.50 MeV respectively. The gamma-ray spectra were investigated using a 20 mm cube sodium iodide crystal and photomultiplier feeding into a Hutchinson–Scarrott type pulse height analyser. A single gamma-ray was observed from the 2.37 MeV state in N^{13}. Peaks observed from Al^{25} could best be explained in terms of excited levels at 0.46, 1.54 and 2.5 MeV. A search was made for γ-radiation accompanying the positron decay of Al^{25} to Mg^{25}. The only peak observed was one at 0.51 MeV corresponding to annihilation radiation. It therefore seems probable that a simple positron transition between the Al^{25} and Mg^{25} ground state takes place. A.

539.172.13 : 539.18

703. ENERGY SPECTRUM OF π^+-MESONS FOR THE $pp \rightarrow np\pi^+$ REACTION AT 556 AND 657 MeV. M.G.Meshcheryakov, V.P.Zrelov, B.S.Neganov, I.K.Vzorov and A.P.Shabudin.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 45-54 (1956). In Russian.

The π^+-spectrum of the $pp \rightarrow np\pi^+$ reaction has been measured for collision energies of 556 and 657 MeV at an angle of 24° with respect to the proton beam by the magnetic analysis method. In the centre-of-mass system the ratio of the differential cross-sections for the reaction $pp \rightarrow np\pi^+$ and an angle of 45° is $(d\sigma^*/d\omega^*)_{657} : (d\sigma^*/d\omega^*)_{556} = 2.2 : 1$. On the average, at any of the two collision energies, about 80% of the available energy is expended in production of a π^+-meson in a single elementary $pp \rightarrow np\pi^+$ reaction. A comparison is made of the measured spectra and the energy distributions corresponding to the statistical weights of the final states computed on the assumption of direct formation of the mesons; it was found that in the low energy region of the π^+-spectra the matrix element relating the initial and final states of the $pp \rightarrow np\pi^+$ reaction linearly increases with the meson momentum and at a given value of the momentum its magnitude is approximately the same for either of the two collision energies. A.

539.172.13

704. ANGULAR DISTRIBUTION OF NEUTRONS IN THE REACTION $T(p, n)He^3$. G.V.Gorlov, B.M.Gokhberg, V.M.Morozov and V.A.Shigin.
Zh. tekh. Fiz., Vol. 26, No. 5, 985-9 (1956). In Russian.

Angular distributions of the neutrons are measured for initial proton energies of 1200, 1400 and 1600 keV. The results at 1400 and 1600 keV agree with those of Jarvis et al. (Abstr. 608/1951) whereas the more accurate measurement at 1200 keV here differs somewhat. G.E.Brown

539.172.13 : 539.166.2

ANGULAR DISTRIBUTION OF 16.1 MeV GAMMA RAYS FROM THE 163 keV RESONANCE IN THE REACTION $B^{11}(p, \gamma)C^{12}$. See Abstr. 672

539.172.13

705. NOTE ON THE $^6Li(d, \alpha)^4He$ REACTION. J.Sawicki.
Acta phys. Polon., Vol. 15, No. 1, 71-3 (1956).

The angular distribution of the products of the $Li^6(d, \alpha)He^4$ reaction for deuteron energies up to 3.75 MeV has been satisfactorily explained in terms of compound nucleus theory by Resnick and Inglis. For higher energy deuterons the Li^6 nucleus can be considered as an α-particle core to which a proton and a neutron are loosely attached, and the $Li^6(d, \alpha)He^4$ reaction is regarded as a process in which these are "picked up" by the incident deuteron. This process is most

probable when the neutron and proton are bound together, giving an "α-particle–deuteron" model for the Li^6 nucleus, which has previously been used to explain experimental results on the $Li^6(n, t)He^4$ reaction. A theoretical angular distribution of the products is calculated for the $Li^6(d, \alpha)He^4$ reaction for 20 MeV incident deuterons. The distribution is symmetrical about $\theta = 90^0$ and shows a pronounced maximum at $\theta \sim 40^0$. No experimental data are available for comparison. D.R.Chick

539.172.13

706. ENERGY LEVELS OF CALCIUM ISOTOPES. $Ca^{40}(d, p)Ca^{41}$ REACTION. C.M.Braams.
Phys. Rev., Vol. 103, No. 5, 1310-13 (Sept. 1, 1956).

The $Ca^{40}(d, p)Ca^{41}$ reaction was investigated with an electrostatic generator, a 180^0 magnetic spectrograph, and a magnetic broad-range spectrograph. Bombarding energies from 2.5 to 7.0 MeV were used; targets were made of natural calcium; and the reaction angle was 90^0. The Q-value for the transition to the ground state of Ca^{41} is 6.140 ± 0.009 MeV. Twenty-five excited states of Ca^{41} were found in the region of excitation from 1.947 to 4.194 MeV. A.

539.172.13

707. ANGULAR DISTRIBUTION OF INELASTICALLY SCATTERED DEUTERONS. J.W.Haffner.
Phys. Rev., Vol. 103, No. 5, 1397-407 (Sept. 1, 1956).

A particle selection technique has been applied to the study of the angular distributions of inelastically scattered deuterons at a bombarding energy of 15 MeV, the angular distributions of the (d, d') reactions from Li^6 (Q = −2.19 MeV), Li^7 (Q = −4.61 MeV), Be^9 (Q = −2.43 MeV), C^{12} (Q = −4.43 MeV), Mg^{24} (Q = −1.37 MeV) and Al^{27} (Q = −2.23 MeV, Q = −2.75 MeV) were obtained. These data were analysed according to the nuclear interaction theory of Huby and Newns, the electric interaction theory of Mullin and Guth, and from the standpoint of compound nucleus formation. The behaviour of the angular distributions indicates that for small angles (large impact parameters) electric interaction contributes appreciably. However, for large angles (small impact parameters) the nuclear interaction theory fits the data better. Consideration of the cross-sections involved favours the nuclear interaction theory. Compound nucleus formation does not appear to play a major role in inelastic deuteron scattering. Improved theoretical treatments of the problem should make possible the determination of the spins and parities of nuclear states not easily reached by other reactions. A.

539.172.13

708. POLARIZATION IN THE ELASTIC SCATTERING OF DEUTERONS FROM COMPLEX NUCLEI IN THE ENERGY REGION 94 TO 157 MeV. J.Baldwin, O.Chamberlain, E.Segrè, R.Tripp, C.Wiegand and T.Ypsilantis.
Phys. Rev., Vol. 103, No. 5, 1502-11 (Sept. 1, 1956).

The elastic double scattering of deuterons by complex nuclei has been investigated experimentally. Measurements were made on carbon, aluminum, and copper near 157 MeV, on lithium, berylium, and carbon near 125 MeV, and on carbon and aluminum at 94 MeV. The expected tensor components of the deuteron polarization have not been found. Measurements have been made of the differential cross-section and vector-type polarization as a function of angle. The observed polarizations were found to be larger than would be expected on the basis of the individual nucleon–nucleus interactions. A.

539.172.13

709. EXCITED STATES OF C^{12} IN THE REGION 11 TO 14 MeV FROM $B^{11}(d, n)C^{12}$ REACTION. E.Kondaiah.
Proc. Indian Acad. Sci. A, Vol. 43, No. 2, 130-2 (Feb., 1956).

A separated B^{11} target was bombarded by 1 MeV deuterons and the outgoing neutron spectra obtained using nuclear emulsions. Statistical analysis of the data indicates levels in C^{12} at 12.0, 12.9, 13.6 and 13.9 (±0.1 MeV). A.O.Stanesby

539.172.13

710. INVESTIGATION OF THE NEUTRON YIELD OF THE REACTION $D(d, n)He^3$ IN BOMBARDING VARIOUS METALS WITH DEUTERONS. K.Fiebiger.
Z. Naturforsch., Vol. 11a, No. 7, 607-8 (July, 1956). In German.

A number of metals from Al, Ag and Au to Ta, Ti, W and Zr and graphite have been bombarded with 300 keV deuterons. The neutron yield has been measured by means of a Hornyak scintillator and a long BF_3 counter. The yield for each substance saturates after a time which may be short as in the case of Fe (20 min) or long (200 min) for Au. The value of the saturation yield also varies widely and rather randomly depending on the nature of the surface and if there are occluded gases or water vapour. The yield decreases with increasing temperature. Steel or Ta are good metals to use as target shields as their saturation yield is low. If the beam is interrupted for a period as long as one hour the yield shows no appreciable fall, they are therefore quite stable targets. D.J.A.Prowse

539.172.13

711. POLARIZATION OF DEUTERONS IN ELASTIC SCATTERING. O.D.Cheĭshvili.
Zh. éksper. teor. Fiz., Vol. 30, No. 6, 1147-8 (1956). In Russian.

Formulae for the differential cross-section in terms of the initial polarization and symmetrical spin tensor are given. The general form of the scattering matrix in spin space is given, and the coefficients of the various terms are expressed in phase shifts and Legendre polynomials. G.E.Brown

539.172.13

712. INVESTIGATION OF (d, p) REACTIONS IN PHOSPHORUS AND CHLORINE. I.B.Teplov.
Zh. éksper. teor. Fiz., Vol. 31, No. 1(7), 25-30 (1956). In Russian.

The angular distribution of protons from the $P^{31}(d, p)P^{32}$ and $Cl^{35}(d, p)Cl^{36}$ reactions has been determined by the thick nuclear emulsion technique. A number of conclusions regarding the excited states of the final nuclei can be drawn on basis of the experimental results. A.

539.172.13

713. THE INTERPRETATION OF THE DISINTEGRATIONS OF LIGHT ELEMENTS PRODUCED BY TRITONS OF 0.9 MeV. D.Magnac-Valette.
C.R.Acad. Sci. (Paris), Vol. 242, No. 6, 760-3 (Feb. 6, 1956). In French.

Targets of Li^6, Li^7 were bombarded by tritons of energy about 0.90 MeV. The secondary particles produced were observed at 90^0 to the primary beam. Several groups of alpha-particles as well as a continuum were observed, and have been interpreted in terms of various possible unstable states of He^6 and He^5. J.H.Fremlin

539.172.3

714. THE PHOTOPROTONS EMITTED FROM OXYGEN-16 NUCLEI. D.L.Livesey.
Canad. J. Phys., Vol. 34, No. 10, 1022-32 (Oct., 1956).

The photographic plate method has been used to study photoprotons emitted from oxygen gas exposed to bremsstrahlung of maximum energies 30, 35 and 70 MeV. The proton energy distributions above 5 MeV show maxima corresponding to peaks in the (γ, p) excitation function at 20.7, 21.9 and 24.0 MeV. The proton angular distributions are anisotropic, in general agreement with a $\sin^2\theta$ function, but the high-energy protons exhibit a degree of asymmetry about the 90^0 angle which may be due to a small electric quadrupole interference effect. A.

539.172.3

715. ON THE NUCLEAR PHOTO-REACTION. I. S.Fujii and S.Takagi.
Progr. theor. Phys., Vol. 14, No. 4, 402-4 (Oct., 1955).

Goldhaber and Teller's theory of the nuclear photoeffect (Abstr. 659/1949) has been re-examined. The collective motion of the nucleus proposed has been considered from the standpoint of different models. The manner in which the dipole vibration is coupled with other forms of nuclear motion is assumed and the mode of nuclear dipole vibration is constructed from the nuclear Hamiltonian. The uniform density and nuclear lattice models with various radii are considered and compared with experiment. Reasonable agreement is obtained, but the theoretical variation of resonance energy with mass number is very dependent on the radius adopted. D.J.Prowse

539.172.3

716. ON THE NUCLEAR PHOTO-REACTION. II. S.Fujii and S.Takagi.
Progr. theor. Phys., Vol. 14, No. 4, 405-6 (Oct., 1955).

Considering the coupling between various nuclear modes to be a first-order perturbation, the widths of the giant resonance for Co^{59} and Nd^{150} have been calculated giving a result about four times larger than the experimental value. Better

agreement is obtained by considering the nucleus as being built up of sub-units such as α-particles. A calculation of the total photo-absorption cross-section for Cu^{63} gives very good agreement with experiment. The width of the resonance is broader for heavier elements but the evidence is against this, possibly indicating that the nuclear structure changes at about neutron number = 20. D.J.A.Prowse

539.172.3

717. THE PHOTODISINTEGRATION OF DEUTERON AT HIGH ENERGY. D.Ito, M.Ono, T.Kato and Y.Takahashi.
Progr. theor. Phys., Vol. 15, No. 1, 74-5 (Jan., 1956).

The maximum of the cross-section around 250 MeV is attributed to the isobar effect which plays an essential role in pion–nucleon scattering and pion photoproduction. A Tamm–Dancoff calculation gives qualitatively the observed variation of cross-section with energy. J.S.Bell

539.172.3

718. RELATION BETWEEN THE QUADRUPOLE MOMENTS AND THE WIDTHS OF THE GIANT RESONANCE OF PHOTONUCLEAR REACTION. K.Okamoto.
Progr. theor. Phys., Vol. 15, No. 1, 75-7 (Jan., 1956).

A close correlation is pointed out in the variation of the widths and moments with atomic number. An explanation in terms of the dynamics of a deformed nucleus is sketched; the observed resonance is interpreted as composed of two overlapping resonances whose centres are separated by the deformation. J.S.Bell

539.172.3 : 530.145

719. NATURE OF NUCLEAR FORCE INDICATED BY THE PHOTODISINTEGRATION OF THE DEUTERON. I.
S.-H.Hsieh and M.Nakagawa.
Progr. theor. phys., Vol. 15, No. 1, 79-81 (Jan., 1956).

The total cross-section for photodisintegration, and its isotropic part, are related to nucleon–nucleon scattering phase-shifts. Of possible sets of phase-shifts due to Garren (Abstr. 3585/1954) that which best fits the corresponding photodisintegration data is $\delta_0^0 = -36^0$, $\delta_1^0 = 10^0$, $\delta_1^1 = -30^0$, $\delta_1^2 = 10^0$. J.S.Bell

539.172.4

720. THERMAL NEUTRON ACTIVATION CROSS-SECTION OF SODIUM. S.J.Cocking and J.F.Raffle.
Atomic Energy Res. Establ. (Harwell) Rep. No. NP/R1894, 5 pp. (1956).

The thermal neutron activation cross-section of sodium has been measured relative to that of gold by comparing the induced activities in sodium carbonate samples irradiated in the thermal column of BEPO with gold foil samples irradiated simultaneously. The induced activity was measured absolutely by β-γ coincidence counting. By taking a value of 98.5 barns for the absorption cross-section of gold for 2200 m/sec neutrons σ_{Na}(absorption)= 0.536 ± 0.006 barns. A.

539.172.4

721. PILE NEUTRON CAPTURE CROSS SECTION OF 33 HR. Ce^{143}. L.P.Roy and L.Yaffe.
Canad. J. Chem., Vol. 34, No. 3, 238-45 (March, 1956).

Ce^{144} has been produced by the successive neutron capture reaction $Ce^{142}(n, \gamma)Ce^{143}(n, \gamma)Ce^{144}$. The pile neutron capture cross-section of the 33 hr Ce^{143} was determined by separating Pr^{144}, the daughter of Ce^{144}, from the rigorously-purified cerium at frequent intervals. The amount of Pr^{144} formed increased linearly with the square of the neutron flux in a manner consistent with that of a successive neutron capture reaction. The value for the pile neutron capture cross-section of Ce^{143} was found to be 6.0 ± 0.7 barn. A.

539.172.4

722. THERMAL NEUTRON CAPTURE CROSS SECTION OF Ce^{142}. L.P.Roy and L.Yaffe.
Canad. J. Chem., Vol. 34, No. 8, 1023-6 (Aug., 1956).

The cross-section of Ce^{142} has been determined by the activation method and found to be 0.95 ± 0.05 barn relative to a value of $\sigma_{Co^{59}}$ = 36.3 barn. Disintegration rates were determined by a 4π counter. The value obtained agrees with that of Katcoff et al. (1949) also obtained by the activation method but differs markedly from that of Pomerance (1952). A.

539.172.4

723. MEASUREMENT OF THE ENERGY SPECTRUM OF PROTONS FROM (n, p) REACTIONS ON Mg AND Zn WITH 14 MeV NEUTRONS. L.Colli and U.Facchini.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 671-3 (Sept., 1956).

The number of high-energy neutrons is much greater than would be expected on the "evaporating compound nucleus" model of the reaction. J.M.Cassels

539.172.4

724. LIMITS TO SOME (n, np) CROSS-SECTIONS AT 14.5 MeV NEUTRON ENERGY. A.V.Cohen, S.B.Hyder and P.H.White.
Nuclear Physics, Vol. 1, No. 4, 278-80 (1956).

An activation technique was used to search for the reaction in Se^{80}, Pd^{108}, Ce^{142} and W^{186}. Upper limits varying from 0.8 to 65 millibarns were placed on the cross-sections. This result is consistent with both the evaporation and the direct knock-out pictures of the reaction mechanism. J.M.Cassels

539.172.4

725. TOTAL NEUTRON CROSS SECTION OF THULIUM IN THE ENERGY REGION 0.038 TO 1.56 eV. E.G.Joki and J.E.Evans.
Phys. Rev., Vol. 103, No. 5, 1326-7 (Sept. 1, 1956).

Measurements of the total cross-section of thulium as a function of neutron energy have been made with the Materials Testing Reactor crystal spectrometer. Twelve cylindrical pellets which contained a total of 2.414 g of metallic thulium were used as a sample. The low-energy data can be described by the expression $\sigma(E) = 6.5 + 20.1\ E_{ev}^{-1/2}$ (barns). The extrapolated value for the total cross-section at 0.0253 eV is 134 ± 3 barns. A.

539.172.4

726. NEUTRON RESONANCE MEASUREMENTS OF Ag, Ta, AND U^{238}. R.G.Fluharty, F.B.Simpson and O.D.Simpson.
Phys. Rev., Vol. 103, No. 6, 1778-86 (Sept. 15, 1956).

Transmission measurements of Ag, Ta and U^{238} cross-sections have been made with a resolution of 0.17 to 0.05μsec/meter and resonance parameters are presented in the energy region from 10 eV to roughly 300 eV. A brief description of the materials testing reactor fast chopper and its performance characteristics is included, and the resolution is demonstrated by resolving new resonances in Ta. Area analysis methods have been used with the primary objective being to determine values of $\bar{\Gamma}_n^0/D$. The values obtained are: Ag^{107}, (0.40 ± 0.16) x 10^{-4}; Ag^{109} (0.82 ± 0.4) x 10^{-4}; Ta^{181}, (1.7 ± 0.3) x 10^{-4}; and U^{238}, (1.55 ± 0.5) x 10^{-4}. These results agree reasonably well with values previously reported. A.

539.172.4

727. THE RELATIVE YIELDS OF THE ISOTOPES OF XENON IN PLUTONIUM FISSION. W.H.Fleming and H.G.Thode.
Canad. J. Chem., Vol. 34, No. 3, 193-200 (March, 1956).

The relative fission yields of five isotopes of xenon in Pu^{239} fission have been determined. Fine structure, similar to that observed in U^{238} fission but smaller, occurs in plutonium fission in the xenon mass range. The yield of the 133 mass chain has been determined at xenon in order to permit the normalization of the relative xenon yields to the relative caesium yields. A.

539.172.4

728. THE YIELD OF Cs^{138} IN THERMAL NEUTRON FISSION OF U^{235}. R.M.Bartholomew and A.P.Baerg.
Canad. J. Chem., Vol. 34, No. 3, 201-5 (March, 1956).

This was investigated using the 4π counting technique. The value obtained for the fission yield is (7.22 ± 0.29) % based on a value of 6.32% for the fission yield of Ba^{140}. The half-life of Cs^{139} was determined and found to be 32.2 ± 0.1 min. A.

539.172.4

729. SOME CUMULATIVE YIELDS OF ISOTOPES FORMED IN THE THERMAL NEUTRON FISSION OF Pu^{239}. D.M.Wiles, J.A.Petruska and R.H.Tomlinson.
Canad. J. Chem., Vol. 34, No. 3, 227-32 (March, 1956).

The relative yields of the isotopes of caesium, cerium, neodymium, and samarium produced by the thermal neutron fission of Pu^{239} have been determined with a mass spectrometer. Preliminary values of the absolute yields of 16 isotopes of these elements together with four yields of the xenon isotopes have been assigned by means of isotope dilution techniques. A.

539.172.4

730. THE RATIO OF XENON TO KRYPTON IN U^{235} FISSION. A.T.Blades, W.H.Fleming and H.G.Thode.
Canad. J. Chem., Vol. 34, No. 3, 233-7 (March, 1956).

The ratio of the yield of Kr^{86} to the yield of Xe^{134} in U^{235} fission is 0.257 ± 0.005 determined by isotope dilution techniques. The corresponding yield ratio of total xenon to total krypton in the thermal neutron fission of U^{235} is 5.52 ± 0.10. A.

539.172.4

731. MEASUREMENTS ON A SUBCRITICAL REACTOR USING A PULSED NEUTRON SOURCE. N.G.Sjöstrand.
Ark. Fys., Vol. 11, Paper 13, 233-46 (1956).

A pulsed neutron source was introduced into the Swedish heavy-water reactor R1 when it was in a subcritical state. The time behaviour of the neutron density was studied by means of a multichannel time analyser. Using this technique the time constant of the prompt neutrons and the reactivity was determined at several heavy water levels down to about 20 cm below the critical level. It was found that the reactivity equivalent of the heavy water is $(7.2 \pm 0.1) \times 10^{-5}$ per mm, and that the mean lifetime of the thermal neutrons in the reactor is 0.68 ± 0.02 msec These values refer to the critical level and are based on a fraction of delayed and photo-neutrons amounting to 0.78×10^{-2}. A calibration of the safety rods gave the result that each of them corresponds to a reactivity of 1.7 ± 0.2 per cent and both together to 3.4 ± 0.4 per cent. A.

539.172.4

732. FISSION PRODUCT FORMATION IN A HOMOGENEOUS POWER REACTOR. C.J.L.Lock.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 1715, 41 pp. (1955).

Calculation has been made of the weight, activity and total neutron absorption cross-section of the individual fission product isotopes present after irradiating a mass of U^{238} for periods of 3, 6, 9, and 12 months at a neutron flux of 10^{15} n/cm^2 sec, the mass of uranium being maintained at 1 kg. An indication is given of the way in which these results can be applied to a homogeneous reactor. A.

539.172.4

733. THE COOLING OF UNDERGROUND FISSION WASTES. J.K.Perring.
Atomic Energy Res. Establ. (Harwell) Rep. No. C/R 1294, 10 pp. (1956).

A method suggested for the disposal of waste fission products involves their adsorption in clay and burial in deep boreholes. Approximate calculations are given by which the temperature of the clay at any time can be found. The results are so arranged that answers can easily be obtained for any mixture of the more common fission products. A.

539.172.4

734. ESTIMATED CONCENTRATIONS OF THE HEAVY ELEMENTS IN A LIQUID METAL FUELLED REACTOR WITH CONTINUOUS CHEMICAL PROCESSING. W.H.L.Porter.
Atomic Energy Res. Establ. (Harwell) Rep. No. M/R1950, 23 pp. (1956).

Tables and charts are presented giving the concentrations of the heavy isotopes in the blanket and core of a homogeneous reactor system with particular reference to a uranium-thorium-bismuth liquid metal fuelled reactor. The processing rates for transfer of fissile material from the blanket to the core are established for steady-state operation. The build-up of non-fissile uranium and fission products on start-up is also discussed. A.

539.172.4

735. A TWO GROUP ANALYSIS OF Z.E.T.R. EXPERIMENTS. F.W.Fenning, C.C.Horton and J.D.McCullen.
Atomic Energy Res. Establ. (Harwell) Rep. No. R/R 1225, 9 pp. (1955).

A two-group analysis has been applied to the Z.E.T.R. results with the intention of deriving a value of η for plutonium. This value of η has then been used in further two-group calculations for bare and water-reflected spheres, infinite cylinders and infinite slabs with cores of plutonium water solutions and plutonium nitrate in 5N nitric acid solutions. A.

539.172.4

736. THE EFFECT OF REMOVING PLATE FUEL ELEMENTS UPON THE THERMAL NEUTRON FINE STRUCTURES IN REACTOR ASSEMBLIES. I. D.A.Newmarch.
Atomic Energy Res. Establ. (Harwell) Rep. No. R/R 1940, 11 pp. (1956).

By means of diffusion theory, an expression has been derived for the thermal neutron fine structure in an infinite reactor assembly where the fuel elements are in the form of plates, a bunch of which has been removed and the resultant gap filled with moderator. A.

539.172.4

737. THE DESIGN OF A LARGE ANTIMONY—BERYLLIUM NEUTRON SOURCE FOR USE WITH EXPONENTIAL ASSEMBLIES. V.S.Crocker and K.J.Henry
Atomic Energy Res. Establ. (Harwell) Mem. No. RP/M 72, 5 pp. (1956).

The design of a large antimony—beryllium neutron source, suitable for exponential experiments is described. Use is made of the usual reactor facilities e.g. use of uranium unload slug coffin for handling the antimony, to keep the cost down to a minimum. The total neutron output, the antimony being saturated in a flux of 10^{12}n/cm^2 sec, is 1.3×10^{10}n/sec ($\sim$ 1230 curies of 1.7 MeV γ-rays). A.

539.172.4

738. THE BUILD-UP OF POISONS ON SHUT-DOWN OF A REACTOR. J.F.Hill.
Atomic Energy Res. Establ. (Harwell) Rep. No. R/M 18, 4 pp. (1956).

It is well known that the amount of Xe^{135} poison in a high flux reactor increases in magnitude when the reactor is shut-down. The build-up of other fission product poisons is considered here and shewn to be only of secondary importance in a thermal reactor operating at a thermal neutron flux as high as 10^{14} neutrons/cm^2 sec. A.

539.172.4

739. REACTOR PARAMETERS OF A LIGHT WATER—NORMAL URANIUM LATTICE. H.Kouts, G.Price, K.Downes, R.Sher and V.Walsh.
J. nuclear Energy, Vol. 2, No. 2, 141 (Dec., 1955).

The following values were measured for a sub-critical lattice of 5 ft long, 1.1 in. diameter, Al-clad, normal uranium rods spaced at 1.779 in. between centres (a water-to-uranium ratio of 1.5 : 1): buckling $B^2 = -(1.74 \pm 0.20) \times 10^{-4}$cm^{-2}, reflector savings = 7.79 ± 0.017 cm, fast fission effect = 1.097, thermal utilization factor = 0.856. R.D.Smith

539.172.4 : 539.185

NEUTRON TEMPERATURE IN GRAPHITE REACTORS.
See Abstr. 765.

539.172.4.084 : 621.317.79

740. PROCEEDINGS OF THE APPLIED NUCLEONICS CONFERENCE, 4TH AND 5TH DECEMBER, 1954. Edited by E.W.Pulsford.
Atomic Energy Res. Establ. (Harwell) Rep. No. EL/R 1616, 68 pp. (1955).

Contains 12 papers intended to exchange information on nuclear instrumentation between A.E.R.E., Harwell and the industry.

ATOM AND MOLECULE BEAMS. MESONS. NEUTRONS 539.18

539.18

741. DECAY MODES AND MEAN LIFE OF SCATTERED K^+-MESONS. N.N.Biswas, L.Ceccarelli-Fabbrichesi, M.Ceccarelli, K.Gottstein, N.C.Varshneya and P.Waloschek.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 631-6 (Sept., 1956).

The investigation described aimed at finding any possible modifications in the relative frequency ratios of the different kinds of decay modes of positive K-mesons as a consequence of nuclear interactions. It has further been investigated whether a considerable number of the heavy mesons originating from nuclear interactions of K-mesons have a mean life substantially shorter than that observed in attenuation experiments. The negative results of our experiment together with other experimental data recently obtained seem to create difficulties for some of the theories on the properties of the τ- and θ-particles. A.

539.18 : 530.145

TABLE OF PROPERTIES OF THE "ELEMENTARY" PARTICLES. See Abstr. 72

539.18

742. ALTERNATE MODES OF DECAY OF NEUTRAL K MESONS. S.B.Treiman and R.G.Sachs.
Phys. Rev., Vol. 103, No. 5, 1545-9 (Sept. 1, 1956).

Consideration is given to the possibility that the θ^0 particle can decay via the "anomalous" modes $(e\pi\nu)$ and $(\mu\pi\nu)$. It is shown that, as a function of time, the decay rate for θ^0 disintegration into a final state of this type, having definite signs of the charges, is the sum of three terms. Two of these are the expected exponentially decaying functions, characterized by the rates λ_1 and λ_2 for decay of the particles denoted as θ_1 and θ_2 by Gell-Mann and Pais. The third term is the product of an exponential having the decay rate $(\lambda_1 + \lambda_2)/2$ and an oscillating factor whose frequency depends on the difference in mass between the θ_1 and θ_2 particles. It arises from interference between θ_1 and θ_2 decay and has opposite signs for the $(e^+\pi^-\nu)$ and $(e^-\pi^+\bar{\nu})$ modes. Similar effects occur for the muon decay modes. This interference may have the effect that the rate of disintegration into any one such final state increases with time during the early stages of decay. The detailed shape of the decay curve may be quite sensitive to the (θ_1, θ_2) mass difference. On the basis of presently available data on "anomalous θ^0" decay events, it is estimated that $1/\lambda_2 > 5 \times 10^{-9}$ sec. A.

539.18

743. NOTE ON THE DECAY INTERACTIONS OF HYPERONS AND HEAVY MESONS. M.Kawaguchi and K.Nishijima.
Progr. theor. Phys., Vol. 15, No. 2, 180-2 (Feb., 1956).

Weak decay interactions are classified into two types: charge-independent decay interactions, and weaker decay interactions. The former are supposed to be spinors in isotopic space and to be associated with lifetimes of order 10^{-10} sec for two-body decays. The latter are associated with lifetimes of order 10^{-8} sec. The implications of this scheme are discussed; the θ meson, for example must have even spin and even parity. J.S.Bell

539.18

744. NOTE ON THE DECAYS OF Σ PARTICLES. M.Kawaguchi and K.Nishijima.
Progr. theor. Phys., Vol. 15, No. 2, 182-3 (Feb., 1956).

The unitarity of the S-matrix gives relations between transition amplitudes for Σ-decay and pion—nucleon scattering phase-shifts. Stronger relations can be obtained if the ideas of the preceding abstract are assumed. These relations involve the spin and parity of the Σ particle and may be useful in determining these. J.S.Bell

539.18

745. ON THE ELEMENTARITY OF THE WEAK BOSON—FERMION INTERACTION. I. S.Ôneda, S.Hori and A.Wakasa.
Progr. theor. Phys., Vol. 15, No. 3, 300-1 (March, 1956).

It is shown that it is not possible to explain $\pi \to \mu + \nu$ and $\pi \to e + \nu$ as compound processes involving finally a universal Fermi interaction. J.S.Bell

539.18

746. ON THE ELEMENTARITY OF THE WEAK BOSON—FERMION INTERACTION. II. S.Ôneda, S.Hori and A.Wakasa
Progr. theor. Phys., Vol. 15, No. 3, 302-4 (March, 1956).

The conditions of Pt I (see preceding abstract) on the Fermi interaction are relaxed to allow the coupling type, but not the coupling constant, to be process dependent. It is shown that this may allow π-decay to be explained, and that the hyperon decays, and possibly $K_\mu \to \mu + \nu$, can then be accounted for similarly on extending the Fermi interaction to four baryons. J.S.Bell

539.18

747. ON K-MESON DECAYS AND THE UNIVERSAL INTERACTIONS. S.Ôneda, S.Hori and A.Wakasa.
Progr. theor. Phys., Vol. 15, No. 3, 304-6 (March, 1956).

The decays $K \to \pi + \pi^0$ and $K \to \mu$ (or e) $+ \nu + \pi^0$ are discussed along lines similar to those of the two earlier papers (see two preceding abstracts). J.S.Bell

539.18 : 778.34 : 537.534.74

MASS MEASUREMENTS IN NUCLEAR EMULSIONS BY MULTIPLE SCATTERING AND GAP DISTRIBUTION. See Abstr. 470

539.18

748. AN ANALYSIS OF THE SPIN AND PARITY OF THE τ-MESON. Y.Eisenberg, E.Lomon and S.Rosendorff.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 610-30 (Sept. 1956).

The generality of the double angular momentum expansion for the final state in τ-meson decay is pointed out. The significance of the relativistic corrections is emphasized. A relativistic analysis is made of the energy and angular distribution of 481 collected events. One or more terms of the expansion are considered. In addition, a classical analysis is made of partially integrated distributions. On the basis of the analysis it is concluded that the τ-meson may have [spin, parity] of [0 −], [1 +] or [3 +] on the basis of a weak set of assumptions concerning the interaction. If stronger assumptions are utilized one can eliminate the [1 +] case or even both the [1 +] and [3 +] cases. A.

539.18

749. PHASE-SHIFT ANALYSIS OF PION—NUCLEON SCATTERING EXPERIMENTS. I. GENERAL OUTLINE. E.Clementel and C.Villi.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 3, 474-89 (1956).

A mechanical analyser composed of a linkage system for finding pion—nucleon phase shifts is described. Behaviour of known sets of phase shifts is discussed following the insight gained by this analysis. Restrictions imposed by causality are included. Possible D-wave contribution is analysed. G.E.Brown

539.18

750. PHASE-SHIFT ANALYSIS OF PION—NUCLEON SCATTERING EXPERIMENTS. II. OPERATIONAL PROCEDURE. I.Gabrielli, G.Iernetti, E.Clementel and C.Villi.
Nuovo Cimento Suppl. (Ser. 10), Vol. 3, No. 3, 496-525 (1956).

Experimental uncertainties in the angular distribution coefficients are taken into account. Determination of the phase shifts at low and intermediate energies is discussed and the procedure is illustrated in detail for scattering of 189 MeV pions. G.E.Brown

539.18

751. NEGATIVE K-PARTICLE ELASTIC SCATTERING FROM HYDROGEN. F.C.Gilbert, C.E.Violet and R.S.White.
Phys. Rev., Vol. 103, No. 6, 1825-7 (Sept. 15, 1956).

Three (K^-, p) scattering events have been found in following 560 cm of negative K-particle track in nuclear track emulsion. The masses of the negative K-particles as calculated from the ranges and angles of the secondaries are not inconsistent with the mass of the τ^+ particle. 1634 cm of track length from other experiments in which no (K^-, p) scatterings were observed have been added to the 560 cm of this experiment to give an elastic scattering cross-section of 44 millibarns. A.

539.18

752. NO-RECOIL APPROXIMATIONS TO CHARGED SCALAR MESON SCATTERING. G.Feldman and P.T.Matthews.
Phys. Rev., Vol. 103, No. 6, 1870-3 (Sept. 15, 1956).

Feynman's method of functional integration is applied to meson—nucleon scattering. The scattering amplitude is obtained exactly in charged meson pair theory with neglect of nucleon recoil, and it is obtained in an approximation to linear charged meson theory with neglect of recoil. The results are the same as one obtains using the Chew—Low method. A.

539.18

753. ELASTIC SCATTERING OF 310 MeV POSITIVE π-MESONS BY PROTONS. E.L.Grigor'ev and N.A.Mitin.
Zh. éksper. teor. Fiz., Vol. 31, No. 1 (7), 37-9 (1956). In Russian.

The angular distribution of 310 MeV π^+-mesons elastically scattered by protons in a photographic emulsion has been measured. 427 events have been used for determination of the differential cross-section in the centre-of-mass system. A phase analysis carried out for a Fermi solution with account of only the S- and P-states yielded the following values for the phase shifts: $\alpha_3 = -23^0$; $\alpha_{33} = 132^0$; $\alpha_{31} = -9^0$. The contribution from the D-state is apparently small compared to that of the S- and P-states. A.

539.18 : 539.166.9 : 539.172

NUCLEAR ABSORPTION OF π-MESON PAIRS PRODUCED BY γ-RAYS. See Abstr. 684

539.18 : 537.591.8

754. ELECTROMAGNETIC INTERACTIONS OF μ-MESONS AT GREAT DEPTHS — DIRECT CREATION OF ELECTRON PAIRS. M.Avan and L.Avan.
C.R. Acad. Sci. (Paris), Vol. 243, No. 1, 38-41 (July 2, 1956). In French.

The cross-section for the direct creation of electron pairs by μ-mesons in nuclear emulsions exposed underground has been measured. At 300 m of water equiv. depth $(\sigma_T)_\mu = 0.72 \pm 0.16 \times 10^{-25}$ cm^2 and at 580 m $(\sigma_T)_\mu = 0.92 \pm 0.22 \times 10^{-25}$ cm^2. The energies of the created pairs were measured by multiple scattering and all lie below 200 MeV. Comparison with the spectrum of pairs created by electrons in the emulsion indicates that the pairs created by μ-mesons have very low energy in agreement with the theory of Bhabha.
D.J.A.Prowse

539.18 : 539.172

CAPTURE OF K^- MESONS BY NUCLEI. See Abstr. 682

539.18 : 539.172

CAPTURE OF π^--MESONS BY URANIUM. See Abstr. 683

539.18

755. DEPOLARIZATION OF STOPPED PARTICLES. W.Thirring.
Nuovo Cimento (Ser. 10), Vol. 4, No. 3, 666-7 (Sept., 1956).

Order of magnitude calculations indicate that K-mesons of spin 1 brought to rest in condensed matter may be depolarized by magnetic interaction with orbital electrons. This could account for negative results in the search for angular correlations among τ-decay products. R.H.W.Johnston

539.18

756. ON PION-PAIR PRODUCTION IN NUCLEAR EMULSIONS. E.M.Friedländer.
Nuclear Physics, Vol. 1, No. 5, 363-5 (April, 1956).

A pair of π-mesons has been found in a glass-backed emulsion exposed on the Pic du Midi. Range scattering measurements indicate the tracks are indeed caused by π-mesons. If they result from the decay of a neutral particle, the mass of this particle is $595 \pm 36\ m_e$. No event was found within 500 μ in which such a particle could have been created, the lifetime must therefore be $> 10^{-12}$ sec. It is pointed out that most anomalous τ^0-decays would give agreement with two-body decay of a particle of mass around 600 m_e. It is further suggested that the peaking of the π-meson energy spectrum from τ^+-decays might be due to at least some τ^+-mesons decaying via an intermediate link involving a neutral particle of mass $\sim 600\ m_e$ which would undergo fast two-body decay into two π-mesons. D.J.A.Prowse

539.18

757. NEUTRAL PION PRODUCTION IN DEUTERIUM AND HYDROGEN : RATIOS. J.C.Keck, A.V.Tollestrup and H.H.Bingham.
Phys. Rev., Vol. 103, No. 5, 1549-57 (Sept. 1, 1956).

Neutral photopion production in deuterium and hydrogen has been studied by counting the decay photons singly. Pure gas targets were used. The photon counter consisted of three counters, the first in anticoincidence and the second and third in coincidence. The photon counting rate was obtained by taking the difference between the counting rates with a Pb converter alternately behind and in front of the anticoincidence counter. Data were obtained for 300, 400 and 500 MeV bremsstrahlung at laboratory angles of 30, 73 and 140°. An attempt to apply the photon-difference method was only moderately successful owing to poor control of the bremsstrahlung end point and the unfavourable shape of the neutral pion excitation curve. At 73° and 140° the data are consistent with a constant value of 0.90 per nucleon for the deuterium-to-hydrogen neutral photopion production ratio. At 30° and 300 MeV there is some evidence for a larger ratio, which points to constructive interference between production on the proton and neutron in the deuteron. The data are consistent with the predictions of the "symmetrical theory" concerning the coupling of neutral pions to nucleons and with Watson's phenomenological theory of photopion production. A.

539.18 : 539.172.13

PRODUCTION OF π^+ MESONS IN p—p COLLISIONS. See Abstr. 691-2

539.18 : 539.172.13

MESON PRODUCTION IN p-p COLLISIONS. See Abstr. 697-701

539.18 : 539.172.13

ENERGY OF π^+ MESONS PRODUCED IN $pp \rightarrow np\pi^+$ REACTION. See Abstr. 703

539.181

758. SCATTERING OF HIGH VELOCITY NEUTRAL PARTICLES. VII. XENON—XENON. I.Amdur and E.A.Mason.
J. chem. Phys., Vol. 25, No. 4, 624-5 (Oct., 1956).

For Pt VI, see Abstr. 2452 (1956). Measurements have been made of the scattering of xenon atoms with energies between 700 and 2100 eV in room temperature xenon. The interaction potential for two xenon atoms, deduced from the variation of total collision cross-sections with energy may be expressed as $V(r) = 1.13 \times 10^{-8}/r^{7.97}$ ergs for r between 3.01 A and 3.60 A. This potential is consistent with others, valid at larger separation distances, which have been obtained from measurements of gaseous compressibility, transport and crystal properties, within the limits of uncertainty of the potentials at the larger distances. A.

539.181

759. SCATTERING OF HIGH VELOCITY NEUTRAL PARTICLES. VIII. H—He. I.Amdur and E.A.Mason.
J. chem. Phys., Vol. 25, No. 4, 630-2 (Oct., 1956).

Total collision cross-sections have been measured for hydrogen atoms with energies between 700 and 2100 eV, scattered in room temperature helium. The results have been analysed to obtain potential-energy information for the interaction between a hydrogen atom and a helium atom. The potential function, which may be represented by $V(r) = 3.75 \times 10^{-12}/r^{3.29}$ erg for r between 1.16 A and 1.71 A, gives values which agree with those calculated quantum mechanically by Mason, Ross and Schatz. The H—He potential has been combined with a potential previously obtained for He—He to obtain a function which, it is suggested, represents the repulsive interaction between two hydrogen atoms. The derived function is in fair agreement with theoretical calculations of Hirschfelder and Linnett for the repulsive $^3\Sigma$ state of the hydrogen molecule. A.

539.181

760. SCATTERING OF HIGH VELOCITY NEUTRAL PARTICLES. IX. Ne—A; A—Ne. I.Amdur and E.A.Mason.
J. chem. Phys., Vol. 25, No. 4, 632-4 (Oct., 1956).

Total collision cross-sections have been measured for neon atoms with energies between 500 and 2100 eV, scattered in room temperature argon, and for argon atoms with the same energies scattered in room temperature neon. The experimental results have been analysed to obtain the following potential energy of interaction between a neon atom and an argon atom: $V(r) = 1.01 \times 10^{-9}/r^{9.18}$ erg, for r between 1.91 A and 2.44 A. This potential is in agreement with one obtained by a simple combination of the potential between two neon atoms with that between two argon atoms. It is also consistent with the potential, valid at larger separation distances, which has been derived from measurements of gaseous compressibility, viscosity and crystal properties. A.

539.181 : 537.533.3

ELECTRON OPTICAL IMAGE OF AN ATOMIC BEAM. See Abstr. 452

539.185 : 539.172

761. PHOTOGRAPHIC EMULSION MEASUREMENTS OF THE ENERGY DISTRIBUTION OF NEUTRONS FROM SPONTANEOUS FISSION OF CALIFORNIUM 252. I. E.Hjalmar, H.Slätis and S.G.Thompson.
Ark. Fys., Vol. 10, Paper 25, 357-68 (1956).

Earlier investigations of the energy distribution of neutrons from fission of U^{235} with thermal neutrons are briefly given. The energy distribution of neutrons from the spontaneous fission of Cf^{252} was investigated by measuring the proton recoil tracks in a photographic emulsion. The energy distribution was corrected for the finite thickness of the emulsion layer and for the varying neutron cross-section. The influence of the finite size of the californium sample on the energy distribution was computed. It was shown that the correction for the finite sample size was negligible. The energy distribution of neutrons from spontaneous fission of Cf^{252} was found to be similar to that for neutrons from thermal neutron fission of U^{235}. A.

539.185

762. NEUTRON FLUXES UNDERGROUND. K.B.Mather.
Austral. J. Phys., Vol. 9, No. 1, 147-50 (March, 1956).

Ilford C2 boron-loaded plates, 200 mμ thick, have been used to determine fluxes in mines, special care being taken to minimize the influence of fading. After exposures lasting about a month, the results must be regarded as negative, since they do not confirm the strong neutron flux reported by Eugster (Abstr. 4664/1954). E.W.Kellermann

539.185 : 539.172

763. NEUTRON PRODUCTION BY ELECTRONS IN URANIUM AND URANIUM–BERYLLIUM. A.W.Aikin.
Proc. Phys. Soc. A, Vol. 69, Pt 5, 419-22 (May, 1956).

Calculations are given of photoneutron yields from a uranium target, and from a uranium convertor plus beryllium target, when bombarded by electrons of up to 35 MeV energy. The uranium target gives the higher yield for electron energies above 11.5 MeV, the yield being about one neutron per hundred electrons at 20 MeV. J.J.Wilkins

539.185

764. A NUMERICAL COMPUTATION OF THE EFFECT OF AN INFINITELY EXTENDED DISK-SHAPED NEUTRON PROBE ACCORDING TO THE TRANSPORT THEORY. H.Meister.
Z. Naturforsch., Vol. 11a, No. 7, 579-85 (July, 1956). In German.

The angular distribution of the neutron field around an infinite extended probe has been computed. The effect of the finite thickness of the probe has also been examined. The calculations have been performed according to a method proposed by Wick for an isotropic scattering law. The results are compared with one already obtained using elementary diffusion theory. D.J.A.Prowse

539.185 : 539.172.4

765. MEASUREMENT OF THE NEUTRON TEMPERATURE IN GRAPHITE. M.Küchle.
Z. Naturforsch., Vol. 11a, No. 8, 676-7 (Aug., 1956). In German.

The experimental technique which involves a measurement of the ratio of the thermal to epithermal neutron flux is described and various corrections are discussed. Results obtained using various graphite and paraffin wax structures are given. Comparison is made between the results of other workers using graphite reactors. H.C.Cole

539.185 : 539.163.2

NEUTRON EMISSION BY A SHORT-LIVED RADIOACTIVE RADIUM DEPOSIT. See Abstr. 655

539.185.7

766. NEUTRON FLUX SPECTRA IN AIR. S.S.Holland, Jr and P.I.Richards.
J. appl. Phys., Vol. 27, No. 9, 1042-50 (Sept., 1956).

Application of the moment method of L.V.Spencer and U.Fano is made to the penetration and slowing down of neutrons in infinite media. General considerations are restricted mainly to those modifications of the method necessary for the neutron problem; in particular, a special technique is given for reducing the integral term of the neutron transport equation. Calculations are carried out for point isotropic monoenergic neutron sources of 1, 100, 500 keV, 1, 2, 5 and 14 MeV in an infinite atmosphere of air. Best available numerical values of the cross-sections are used, and the effects of absorption, anisotropic angular distributions, and inelastic scattering are included. Distances out to 10 mean free paths are considered. A.

539.185.9 : 539.531

767. EFFECT OF IRRADIATION ON THE HARDNESS OF ALPHA-URANIUM. P.E.Madsen.
Atomic Energy Res. Establ. (Harwell) Rep. M/R 741, 11 pp. (1956).

The paper describes the continuation of work reported in A.E.R.E. M/R 382. Further irradiations show that at a flux of 10^{11} neutrons/cm^{2}sec cold-worked uranium softens and annealed uranium hardens. Both worked and annealed specimens from fresh uranium sheet show a drop in hardness on the first irradiation in a flux of 10^{11} neutrons/cm^{2}sec. Further irradiation causes the hardness of the worked specimens to vary within a band of 14 Brinell, while the annealed specimens show a significant though slight hardening with time. This behaviour was compared with the effect of annealing unirradiated material at 150° C from which it is concluded that the behaviour of uranium under irradiation cannot be entirely explained by the heating effect produced by irradiation. Annealing experiments show that the hardness induced by irradiation is stable at 150° C but can be removed at 220° C. The results are consistent with the view that the hardness changes in uranium on irradiation are the net effect of the competing processes, hardening by atom disturbance from normal sites and thermal recovery. A.

539.185.9 : 539.42

768. THE EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PROPERTIES OF METALS. I. TITANIUM AND ZIRCONIUM. M.J.Makin and F.J.Minter.
Atomic Energy Res. Establ. (Harwell) Rep. No. M/R 2009, 11 pp. (1956).

The changes in mechanical properties of titanium and zirconium after irradiation with 5 x 10^{19} neutrons/cm^2 have been studied at a variety of temperatures. The yield stress of annealed titanium increased by about 8000 lb/in^2 at all testing temperatures between −195° and +200° C. A yield point was developed at 200° C which indicates the migration to dislocations of vacancies produced by the irradiation. The elongation before fracture was reduced by the irradiation at all testing temperatures. The yield stress of heavily cold-worked zirconium decreased slightly at all testing temperatures after irradiation and the elongation before fracture increased. The reason for this "annealing" effect in heavily cold-worked metal is discussed in terms of the atomic defects produced and also in terms of the Brinkman displacement spike mechanism. A.

539.185.9 : 539.27

769. NEUTRON RADIOGRAPHY. J.Thewlis.
Brit. J. appl. Phys., Vol. 7, No. 10, 345-50 (Oct., 1956).

The absorption of neutrons by matter is considered and the raison d'etre of neutron radiography explained. The production and detection of neutrons are described and details are given of the techniques used for neutron radiography at Harwell. Some examples of neutron radiographs are reproduced and discussed. A.

STRUCTURE OF SOLIDS 539.2

539.21 : 548.7

770. ACTION OF HIGH-ENERGY RADIATIONS ON SOLIDS. [Action des Rayonnements de Grande Energie sur les Solides.] Gauthier-Villars (1956) 139 pp. [Monographies de chimie physique.]

A collection of eleven papers presented at a seminar of Physical Chemistry (Spring 1955). The papers take the form of critical reviews. The active radiations introducing defects in solids are principally high-energy electrons and fast neutrons, but gamma-rays and slow electrons are also taken into consideration. The substances irradiated are most often crystalline solids, but one article specially considers solid polymers. The titles and authors are as follows: Y.Cauchois, Introduction (1-4); J.Friedel, Defects in crystals (5-36); N.F.Mott, Remarks on point defects in solids (37-8); A.Herpin, The creation of defects by radiation (39-66); J.Blin, Effects of radiations on metals (67-80); P.Aigrain, The effect of radiations on semiconductors (81-8); H.Curien, The thermal conductivity of dielectric crystals. Effect of radiations (89-97); G.Mayer, Effect of fast neutrons on graphite and quartz (99-108); P.Perio, M.Tournarie and M.Gance, Some effects of irradiation on the structure of solids. Preliminary study of the effects of irradiation of LiF by neutrons (109-16); M.Lambert and M.A.Guinier, Study by X-ray scattering diagrams of irradiated LiF (117-20); A.Chapiro, Action of high-energy radiation on solid polymers (121-33); J.Uebersfeld, Paramagnetic electronic resonance and lattice defects in solids (135-39).

539.21 : 537.523.4

771. ON THE EFFECT OF ELECTRO-EROSION. M.Bruma and J.Roncin.
C.R. Acad. Sci (Paris), Vol. 243, No. 3, 249-51 (July 16, 1956). In French.

Rate of reduction of electrode mass due to spark erosion was measured for a brass cathode and steel anode. Comparison with theory yielded good agreement. C.G.Morgan

539.211.08

772. MEASUREMENT OF THE TRUE SURFACE OF A METAL. S.S.Gutin, L.L.Prochakov and M.G.Serbulenko.
Zh. tekh. Fiz., Vol. 26, No. 4, 865-9 (1956). In Russian.

A method based on the measurement of the total capacitance of the electrical double layer formed on the surface of a metal placed in a solution is described for obtaining relative values of the total surface area of a metal. The method has been applied to the study of the variation of surface area of aluminium foil during etching. R.C.Murray

539.215.08

773. RECORDING, PHOTOMETRIC PARTICLE-SIZE ANALYZER. N.A.Talvitie and H.J.Paulus.
Rev. sci. Instrum., Vol. 27, No. 9, 763-7 (Sept., 1956).

An analyser has been developed which is useful in comparing the particle-size distribution of dusts in the subsieve range. The instrument follows the progress of the sedimentation of a suspension by means of a collimated beam. Provision for continuously varying the sedimentation depth allows analysis of the entire range within 1 hr. The optical system and temperature control were designed to increase the accuracy of analysis of the finer particles. A simplified system is given for calibrating the sedimentation curves in terms of particle size. A.

539.217

774. THE EFFECT OF INTERSTITIAL ATOMS ON THE SELF-DIFFUSION OF A METAL. M.A.Krivoglaz and A.A.Smirnov.
Dokl. Akad. Nauk SSSR, Vol. 96, No. 3, 495-8 (1955). In Russian. English translation in: Atomic Energy Res. Establ. (Harwell) Transl. No. 642, 5 pp. (1956).

Equations are derived by statistical thermodynamics which give a qualitative interpretation of the linear decrease of effective energy of activation of self-diffusion and exponential decrease of the pre-exponential factor in the coefficient of self-diffusion of iron, with increase of the (small) percentage of carbon in gamma-iron. R.C.Murray

539.217

775. ON THE FORM OF PORES ARISING IN THE MUTUAL DIFFUSION OF METALS. Ya.E.Geguzin.
Dokl. Akad. Nauk SSSR, Vol. 100, No. 2, 255-8 (1955). In Russian. English translation in: Atomic Energy Res. Establ. (Harwell) Transl. No. 615, 4 pp. (1956).

Studies of diffusion of Zn from α-brass into Cu. The α-brass is enriched in holes and the systems can be regarded as a supersaturated solution of holes in the metal, from which the phase corresponding to the holes must separate. The form of the pores formed is the same as that of small crystals of the metal in which they arise — in this case cubical. A.E.De Barr

539.217 : 535.345 : 537.31

776. DIFFUSION PARAMETERS AND X-RAY ABSORPTION SPECTRA IN ALLOYS. I.Ya.Dekhtyar.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 6, 1069-71 (1956). In Russian.

In cobalt–chromium solid solution alloys the activation energy for diffusion and the shift of K-absorption egde are related to the number of unpaired 3d-electrons. J.Adam

539.217

777. CORRELATION BETWEEN FREQUENCY FACTOR AND ACTIVATION ENERGY FOR SOLUTE DIFFUSION. R.A.Swalin.
J. appl. Phys., Vol. 27, No. 5, 554-5 (May, 1956).

Recent experiments on solute diffusion in silver and nickel indicate that a correlation exists between the constants D_0 and Q in the expression used to represent the solute diffusion coefficient, $D = D_0 \exp(-Q/kT)$. The correlation predicted by the Lazarus theory (Abstr. 5019/1954) is presented here. Agreement with experiment is satisfactory for silver but not so good for nickel. A.B.Lidiard

539.217

778. FURTHER NOTE ON THE APPLICATION OF THE BOLTZMANN–MATANÒ ANALYSIS TO VAPOR-SOLID DIFFUSION COUPLES. H.Fara and R.W.Balluffi.
J. appl. Phys., Vol. 27, No. 8, 964-5 (Aug., 1956).

The original application (Abstr. 7783/1954) is modified to allow for the additional term expressing the velocity, $\phi(t)$, of the vapour-solid surface. W.Good

539.217.5

779. THE FLOW OF AIR THROUGH BEDS OF CHARCOAL. W.M.Jones.
Brit. J. appl. Phys., Vol. 7, No. 10, 370-3 (Oct., 1956).

It is shown experimentally that the flow of air through beds of irregular porous granules of charcoal may be correlated with that through beds of solid spheres by using the usual equations for flow through granular beds. The envelope specific volumes of the charcoal granules are found with mercury after impregnating the granules with paraffin wax, and the envelope specific surface areas of the granules are deduced from measurements of the projected area and shape of the granules, according to the procedure laid down by Heywood. A.

539.219 : 548.73

780. LOCAL ATOMIC DISPLACEMENTS IN SOLID SOLUTIONS. F.H.Herbstein, B.S.Borie, Jr. and B.L.Averbach.
Acta cryst., Vol. 9, Pt 5, 466-71 (May, 1956).

The static displacements of atoms in binary solid solutions from the sites of the average lattice can be determined from measurements of the Bragg intensities. Appreciable local static displacements have been found in the disordered alloys Cu_2Au, CoPt, NiAu and LiMg. For the first three alloys, a good correlation between these measurements and those of the size-effect diffuse-scattering was obtained, using a theory which is based on an elastic model of the solid solution. The present measurements also confirm the essential correctness of the atomic displacements previously deduced from diffuse-scattering measurements. A.

539.219

781. SOLUBILITY OF LITHIUM IN DOPED AND UNDOPED SILICON, EVIDENCE FOR COMPOUND FORMATION. H.Reiss, C.S.Fuller and A.J.Pietruszkiewicz.
J. chem. Phys., Vol. 25, No. 4, 650-5 (Oct., 1956).

The solubility of lithium in silicon from a lithium–silicon alloy phase has been redetermined. The original data of Fuller and Ditzenberger appear to be in error. The solubility of lithium, from the same phase, in boron-doped silicon has also been determined. At both low and high temperatures the solubility in the doped crystal markedly exceeds that in the undoped one. In fact, the solubility just about equals the boron concentration in these ranges. The low temperature disparity can be explained in terms of hole–electron equilibria while the high temperature effect is believed due to covalent bond formation between lithium and boron. A quantitative theory is developed which predicts the experimental results. A.

539.219

782. PHASE DIAGRAM OF IRON–COBALT–OXYGEN SYSTEM. I. EXPERIMENTAL STUDY. S.Iida.
J. Phys. Soc. Japan, Vol. 11, No. 8, 846-54 (Aug., 1956).

The phase diagram has been established experimentally in certain temperature, pressure and composition ranges ($900^\circ C \sim 1400^\circ C$, $10^{-4} \sim 760$ mm Hg, $Fe_{1-x}Co_x \sim$ Oxygen, $0 \leq x \leq 1/3$). In these ranges, when the temperature and the mixing ratio of metallic elements are fixed, it has been found that spinel phase is stable below a certain critical pressure of oxygen. Above this pressure, precipitates of haematite are formed in the spinel matrix, resulting in an abrupt increase of the total oxygen content in the solid phases. The phase boundary was determined by observing the change of the oxygen pressure in a sealed tube, which resulted from the oxidation or reduction of the specimen. Results of several measurements of specific heat on heating from $100^\circ C$ to $750^\circ C$, the variations in oxygen content during heat-treatment, and the change of lattice constants at room temperature with heat-treatment, are presented. Curves of lattice constants v. composition of metallic constituents have a minimum at compositions intermediate between magnetite and cobalt ferrite. It has been concluded that the diffusion rate of ions in these oxides varies exponentially in passing through the temperature range around $300^\circ C$. No result has been obtained which favours the existence of structural change in the temperature range from $200^\circ C$ to $400^\circ C$ (effective range for magnetic anneal), for all these ferrites. A.

539.219 : 548.7

783. INTERACTION OF DISLOCATIONS WITH ATOMIC ORDER IN SOLID SOLUTION. K.Sumino and M.Yamamoto.
J. Phys. Soc. Japan, Vol. 11, No. 8, 897 (Aug., 1956).

In order–disorder or superlattice alloys the like atom pair bond length may be different from that for an unlike atom

pair and the stress field of a dislocation may then interact with the strain resulting from the occurrence of unlike pairs. This note briefly describes the calculation of that part of the energy of a dislocation (E) which depends on the atomic order. E is shown graphically as a function of temperature for a pure edge and a pure screw dislocation in a β-brass type of alloy.

A.B.Lidiard

539.219

784. SOLID STATE REACTION BETWEEN BARIUM TITANATE AND STRONTIUM TITANATE. S.Nomura.
J. Phys. Soc. Japan, Vol. 11, No. 9, 924-9 (Sept., 1956).

The first stage of the sintering process between barium titanate and strontium titanate powders, which are responsible for the formation of solid solution, was investigated. The variation of permittivity v. temperature characteristics and crystal structure of the mixtures, with sintering conditions, was measured. The shift of the effective Curie temperature and the broadening of diffracted lines were observed in the transient states of the reaction. A diffusion mechanism was introduced in order to interpret these phenomena qualitatively.

A.

539.219 : 548.7

785. STRUCTURAL STUDY OF IRON SELENIDES $FeSe_x$. I. ORDERED ARRANGEMENT OF DEFECTS OF Fe ATOMS. A.Okazaki and K.Hirakawa.
J. Phys. Soc. Japan, Vol. 11, No. 9, 930-6 (Sept., 1956).

The ordered arrangements of the defects of iron atoms in $FeSe_x$ have been studied for several compositions by X-ray analysis. These defects tend to assume an ordered arrangement as in the case of pyrrhotite $FeS_{1.14}$. New phases are found in the region ($x = 8/7 \sim 4/3$) which have been considered as the single phase region. If the orthohexagonal and pseudo-orthohexagonal unit cells are chosen for $x = 8/7$ and $4/3$, respectively, the unit cell dimensions of the superstructure resulting from this ordering are twice as large as that of the fundamental structure along the a- and b-axes, and three times along the c-axis for $x = 8/7$, and on the other hand, twice only along the c-axis for $x = 4/3$. A.

539.219 : 536.423.15.08

Hg VAPOUR PRESSURE OF AMALGAMS. See Abstr.318

539.23 : 539.219

786. DECOMPOSITION OF SOLID SOLUTIONS IN THIN LAYERS. M.I.Zakharova and I.N.Soboleva.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 841-2 (1956). In Russian.

From measurements of the lattice constant of Cu-Al, Al-Zn, and Al-Mg alloys it is shown that below a certain thickness, tempering produces heterogeneous breakdown in the first two cases in contrast to homogeneous decomposition above this thickness. When an Al-10% Mg alloy is tempered at 218°C, breakdown is homogeneous for the first 12 hours in specimens 0.03 and 0.3 mm thick, but heterogeneous breakdown sets in after 12 hours for the 0.03 mm, and only after about 45 hours in the 0.3 mm thick specimen. R.C.Murray

539.23 : 539.576

787. WEAR RESISTANCE OF MAGNESIUM FLUORIDE FILMS ON GLASS. L.Holland and E.W.van Dam.
J. Opt. Soc. Amer., Vol. 46, No. 10, 773-7 (Oct., 1956).

The wear resistance was examined using a machine fitted with an abrader containing emery powder. The test specimen was rotated as the abrasion head moved over its surface producing a central region of maximum wear. An empirical figure of merit could be assigned to the coating under test by measuring the ratio of the area of coating removed to the total area abraded. It was confirmed that the hardest wearing deposits were formed when the glass specimen had been glow discharge cleaned and raised to 300°C before coating. Burnishing and/or heating the coatings before abrasion testing also increased their wear resistance. The wear resistance of coatings deposited at normal vapour incidence progressively decreased as their thickness increased. The fall in the wear resistance of thick films was attributed to the film deforming under the abrasive action so that particles could be torn from the deposit. Films of constant surface density were deposited at different vapour incidence angles and up to 19° showed a dependence of wear resistance on film thickness, but not on the incidence angle. $\lambda/4$-films condensed above 50° had poor wear resistance owing to a porous texture. The wear resistance in this incidence region was a function of both vapour incidence and film thickness. Increasing either the mass deposited or the incidence angle produces a coarse texture because irregularities in the film surface prevent uniform condensation. These results are of practical importance when coating lenses of strong curvature. A.

539.231

788. ELECTRIC CONDUCTIVITY AND STRUCTURE OF SPUTTERED INDIUM OXIDE FILMS. A.Thelen and H.König.
Naturwissenschaften, Vol. 43, No. 13, 297-8 (1956). In German.

The influence of oxygen concentration on indium films is investigated electrically and with electron diffraction studies. Films prepared in pure nitrogen have a conductivity about 10 x as high as those prepared by other methods. With a thickness < 1500 A there is hardly any absorption of visible radiation. R.A.Weale

539.231

789. CATHODIC SPUTTERING. AN ANALYSIS OF THE PHYSICAL PROCESSES. A.Guentherschulze.
Vacuum, Vol. 3, No. 4, 360-74 (Oct., 1953; publ. Dec., 1955).

Review article.

539.234

790. RECOVERY PROCESS IN THE EVAPORATED METAL FILMS. Y.Mizushima and O.Ochi.
J. Phys. Soc. Japan, Vol. 11, No. 8, 893-4 (Aug., 1956).

Evaporated Cu, Ag, and Au films were annealed between temperatures θ of -150 to $+50$°C, the time t of exposure to the various temperatures being varied in different samples. The activation energies E of the resistivity recovery were shown to depend markedly on t, and only the regions for which $dE/d\theta = 0$ have any physical meaning. R.A.Weale

539.234

791. THE EFFECT OF THE SUBSTRATE TEMPERATURE ON THE CONDENSATION COEFFICIENT OF EVAPORATED ANTIMONY, GOLD AND SILVER. F.M.Devienne.
Vacuum, Vol. 3, No. 4, 392-7 (Oct., 1953; publ. Dec., 1955).

After a brief reference to previous work on the effect of the thickness of the deposit on the condensation coefficient of antimony and cadmium evaporated on to supports maintained at normal temperature, the author reports the results of a recent investigation into the effect of the change in substrate temperature on the condensation coefficient of antimony and gold. These experiments were conducted with radioactive isotopes and confirm the thoeretical assumption that the condensation coefficient decreases as the substrate temperature increases. In the case of antimony the decrease is considerable, even if the substrate temperature has been raised only slightly. In the case of gold the condensation coefficient hardly decreases at all and remains at a value near unity as long as the substrate temperature is not higher than 100°C. But when the temperature rises beyond 300°C the coefficient of gold decreases appreciably as long as the thickness of the deposit is small. The condensation coefficient depends not only on the thickness of the film but also on the nature of the film support as was to be expected from the results of the previous experiments with antimony and cadmium at normal substrate temperature. Experiments with silver indicate a value near unity as long as the film is thin and deposited on substrates maintained at normal temperature. Here, as in the case of gold, the condensation coefficient appears to decrease when the substrate temperature rises beyond 300°C. However, as the radio-activity of silver is poor no precise numerical values can be given. A.

539.234 : 537.311.31

RESISTANCE OF THIN METAL FILMS. See Abstr. 361

539.26 : 536.424.1

792. X-RAY STUDY OF THE ALKALI METALS AT LOW TEMPERATURES. C.S.Barrett.
Acta cryst., Vol. 9, Pt 8, 671-7 (Aug., 1956).

Using a spectrometer having provision for cold working and X-raying specimens in a high vacuum at low temperatures, it is found that sodium partially transforms on cooling (below 36°K) or on deforming (below 51°K) to a close-packed hexagonal structure with stacking faults, having $a = 3.767$, $c = 6.154$ A, $c/a = 1.634$ at 5°K, this coexisting with body-centred cubic sodium of $a_0 = 4.225$ A. The body-centred cubic form at 78°K has $a_0 = 4.235$ A. Severe cold work at 5°K

transforms about half of the material to the hexagonal form; subsequent reversion to cubic starts on heating to 60-75°K and is completed at 100-110°K, or at lower temperatures if there has been no cold work. Reversion can be aided by cold work at 45-100°K. High-purity severely deformed sodium recrystallizes at 98°K. Patterns of lithium that has been cooled can be interpreted similarly, and indicate a phase of close-packed hexagonal structure with parameters a = 3.111, c = 5.093 A, c/a = 1.637 (which differ from the earlier, tentative ones). This phase coexists with the body-centred cubic phase of a_0 = 3.491 A, at 78°K. Confirming the earlier work, hexagonal lithium is converted to face-centred cubic by cold working. Potassium, rubidium and caesium retain their body-centred cubic structure after cooling and cold working at 5°K, with a_0 = 5.225, 5.585 and 6.045 A respectively at 5°K and with a_0 = 5.247, 5.605 and 6.067 A at 78°K. A.

539.27

793. A REPLICA TECHNIQUE FOR PARTICLE SURFACES. J.Marriott.
Brit. J appl. Phys., Vol. 7, No. 10, 373-4 (Oct., 1956).

Difficulty is often experienced in the interpretation of electron micrographs of pigments as surface detail cannot normally be observed. A simple technique for the preparation of shadowed carbon replicas of zinc sulphide and lithopone is described. The use of a selective leaching agent permitting differentiation of the zinc sulphide and barium sulphate in lithopone is demonstrated. A.

539.27

794. SURFACE STRUCTURE OF SILVER MIRRORS. H.König and E.Kirste.
Naturwissenschaften, Vol. 43, No. 11, 248 (1956). In German.

Electron diffraction of silver films evaporated on platinum substrates demonstrate the formation of an AgCl film if the silver film is left exposed to air. R.A.Weale

ELASTICITY. STRENGTH. RHEOLOGY

539.3/.8

539.32 : 548.0

795. A SIMPLIFIED CALCULATION FOR THE ELASTIC CONSTANTS OF ARBITRARILY ORIENTED SINGLE CRYSTALS. D.S.Lieberman and S.Zirinsky.
Acta cryst., Vol. 9, Pt 5, 431-6 (May, 1956).

A simple, completely general, and easily remembered scheme is presented for solving problems involving the transformation of elastic constants from one orthogonal coordinate system to another rotated with respect to the first. Since the components of stress can be expressed as the elements of a second-rank tensor, and the components of strain (if properly defined) can likewise be expressed as the elements of a second-rank tensor, the elastic constants connecting stress and strain must be the elements of a fourth-rank tensor. The method depends upon the simultaneous contraction of the fourth-rank tensor and the quadratic products of the direction cosines connecting the two axis systems. The application of the resultant "transformation matrix", instead of the conventional methods, reduces the number of steps to a minimum with a corresponding reduction in the chance for errors in the computation. The saving in time and labour is considerable, as is shown by typical examples. A.

539.32

796. DETERMINATION OF ELASTIC CONSTANTS OF METALS AND ALLOYS BY TEMPERATURE DIFFUSE SCATTERING OF X-RAYS. S.Annaka.
J. Phys. Soc. Japan., Vol. 11, No. 9, 937-43 (Sept., 1956).

A new simple but fairly accurate method for the determination of elastic constants of cubic crystals from the observation of the temperature diffuse scattering of X-rays has been developed. The elastic constants of silver, copper–zinc and silver–copper alloys were determined by this method. Diffuse scattering due to the disorder of atoms as well as due to the thermal motion of atoms were considered in the case of alloys. In silver–copper alloy, the abnormal diffuse scattering, probably due to the former cause, was found along the [001] direction from the (004) reciprocal lattice point. A.

539.371

797. ELASTIC COMPLIANCE OF POLYMETHYL METHACRYLATE. J.M.Watkins.
J. appl. Phys., Vol. 27, No. 4, 419-20 (April, 1956).

A theoretical equation giving the steady-state elastic compliance of a concentrated polymer solution in terms of the molecular weight distribution is tested experimentally by observing elastic recovery from steady flow in a rotational viscometer on removal of the stress. Reasonably good agreement is obtained by assuming exponential molecular weight distributions for whole polymers and fractions and a corresponding bimodal distribution for a blend. J.G.Oldroyd

539.374

798. ON THE FOUNDATIONS OF THE THEORY OF NON-HOMOGENEOUS ELASTO-PLASTIC BODIES. II. W.Olszak.
Bull. Acad. Polon. Sci. Cl. 4, Vol. 3, No. 3, 111-17 (1955).

Continuation of previous work (see Abstr. 724/1956). Equations are formulated which describe the plastic flow when the yield value and the parameters in the stress–strain relations are general functions of position. Elastic terms in the equations are taken into account. Special attention is given to the case when the yield criterion at any point is related to the local stress–strain relations by its identification with the attainment of a certain value of the shear strain energy. J.G.Oldroyd

539.374

799. FORMATION OF SUBMICROSCOPIC INHOMOGENEITIES IN PLASTIC DEFORMATION OF ROCKSALT. R.I.Garber, I.V.Obreimov and L.M.Polyakov.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 425-6 (1956). In Russian.

Rocksalt crystals are selected which show virtually no turbidity. They are mounted in a beam of light and subjected to longitudinal stress. When gliding sets in an appreciable intensity of Tyndall scattering is observed; intensity increases with increasing distortion. Experiments are interpreted by assuming that the gliding planes are occupied by submicroscopic scattering centres. R.Eisenschitz

539.374

800. DETERMINATION OF DISPLACEMENTS OF POINTS IN A SYSTEM UNDER STRAIN. L.N.Borob'ev.
Dokl. Akad. Nauk SSSR, Vol. 109, No. 3, 465-8 (1956). In Russian.

The principle of virtual displacements as applied in the ordinary theory of elasticity is re-formulated in such a way that it can be applied to finite strain and to imperfectly elastic bodies. R.Eisenschitz

539.374

801. RELEASE OF STORED ENERGY AND CHANGES IN LINE SHAPE DURING ANNEALING OF DEFORMED NICKEL. D.Michell.
Phil. Mag. (Ser. 8), Vol. 1, No. 6, 584-7 (June, 1956).

As the first stage in a programme of correlating the changes of X-ray line shape with the changes of electrical resistivity, density and hardness which occur on annealing (Abstr. 10008/1955), the energy stored in deformed nickel powder has been measured and the line shapes determined on the same powder at various stages of annealing. A full account is to be published. W.Bardsley

539.374

802. ON A MINIMUM PRINCIPLE IN ELASTIC-PLASTIC STATES. M.V.de Pando.
Rev. Cienc. apl., Vol. 10, 97-100 (March-April, 1956). In Spanish.

A basic explanation of the minimum principle relating to the equilibrium states of elastic–plastic systems as proposed by Professor Colonetti is given; then the hypotheses on which the theory is based are critically examined, in particular their connection with the published theories on plasticity, and it is shown that three such hypotheses can be assumed: (1) The elastic–plastic transformation under investigation consists in a succession of equilibrium states, and Colonetti's principle refers to one of these. It should be noted that this hypothesis agrees with Velasco De Pando's plasticity theory, but not with the traditional theory. (2) The total deformations are sufficiently small for their squares and higher powers to be neglected, as well as their products. (3) The readjustment of the tension during the plastic period is independent of the

plastic deformation. The author states that Colonetti's principle can be very useful in the investigation of small deformations, since it is sufficiently accurate for such cases. J.Smuts

539.389.4 : 538.653.1

803. THE MAGNETOMECHANICAL HYSTERESIS LOOP OF NICKEL. M.Kornetzki.
Z. Phys., Vol. 146, No. 1, 107-12 (1956). In German.

Reports results of measurements of the stress–strain relation of a nickel tube under the action of alternating torsional stresses of peak value 0.04-0.4 kg mm^{-2}. The relation is double valued and the magnetomechanical Rayleigh law is obeyed up to about 0.2 kg mm^{-2}. The "coercive force" is about 0.1 kg mm^{-2}. E.P.Wohlfarth

539.42 : 539.185.9

EFFECT OF NEUTRON IRRADIATION ON MECHANICAL PROPERTIES OF Ti AND Zr. See Abstr. 768

539.531 : 539.185.9

EFFECT OF NEUTRON IRRADIATION ON HARDNESS OF α-U. See Abstr. 767

539.576

804. ON THE LAW OF ADHESIVE WEAR.
H.P.Bhattacharyya.
J. appl. Phys., Vol. 27, No. 6, 661-2 (June, 1956).

Holm (1950) has proposed the formula V = KAL for volume of wear (V) at low stress in terms of true contact area A and distance of travel L (K constant). The present author suggests that departure from linear relation observed experimentally at high stress can be explained by assuming volume V composed of two parts, viz. V = B(1 + exp CP)AL, where B and C are constants and P = normal stress. At low stress this expression approximates to Holm's since exp CP → 0 as P → 0. J.W.Menter

539.62

805. DEMONSTRATION OF THE STATIC FRICTION OF RESIN WITHOUT GREASE. S.B.Ratner and V.V.Lavrent'ev.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 3, 461-4 (1956). In Russian.

A sample of resin is pressed by a known weight against a supporting plate and pulled slowly by a motor in horizontal direction. Displacement and force are recorded. At the beginning of an experiment the force rises from zero to a finite value before any displacement occurs. Eventually displacement starts and is accompanied by an increase in the force. If the motor is switched off velocity and displacement decrease; whereas the velocity drops to zero, the force keeps a finite value. This force remains constant over an appreciable time if the apparatus is left at rest. The experimental results are interpreted by expressing the frictional force as the sum of a "static" and a "kinetic" contribution. R.Eisenschitz

539.62

806. FRICTION BETWEEN SOLIDS AT HIGH PRESSURES AND THE EQUILIBRIUM DIAGRAM OF THE TWO SUBSTANCES. A.Knappwost and H.Lipke.
Naturwissenschaften, Vol. 43, No. 10, 222-3 (1956). In German.

The coefficient of friction was measured for Zn, Cu, Al and Mg, in each case against Fe, under paraffin oil, for slip velocities of 2, 4, 6, and 8 cm/sec, for pressures ranging up to 1200 kg/cm^2. Apart from a minimum for small pressures, the coefficient increases monotonically with pressure. This is ascribed to interpenetration and consequent formation of intermetallic compounds (e.g., Al_3Fe) at the higher pressures. N.Corcoran

539.62 : 537.311.3

807. COMPARISON OF FRICTION AND ELECTRIC CONDUCTIVITY OF RESIN. S.B.Ratner and V.V.Lavrent'ev.
Zh. tekh. Fiz., Vol. 26, No. 4, 853-6 (1956). In Russian.

Samples of resin are prepared to which solid powders are added in varying proportions; soot, graphite and aluminium are used as admixtures. Measurements are made of dependence of the friction on the load by which the sample is pressed against a supporting plate. In addition the strength and the electric conductivity of the sample are measured. The latter measurements show clearly the proportion of admixture at which the grains of powder come into contact. If the proportion is lower the admixtures cannot accumulate at the surface; in accordance with the views of the authors they should not then affect the friction to any appreciable amount. This conclusion appears to be confirmed by the experiments. It is found in addition, that the frictional force divided by the load tends to a finite, non-vanishing limit when extrapolated to infinite load. R.Eisenschitz

539.62

808. DRY EXTERNAL FRICTION WITH OSCILLATIONS OF A BODY RUBBED AS A WHOLE. G.D.Lomakin.
Zh. tekh. Fiz., Vol. 26, No. 4, 857-64 (1956). In Russian.

A solid body is pressed by its weight against a supporting plate which is in motion; the body is held by a horizontal force due to a helical spring. It sometimes follows the movement of the support and retracts abruptly, sometimes performs harmonic oscillations and sometimes stays at rest. The type of movement depends on the instantaneous and the past velocities of the plate. The behaviour of this complex system is investigated by a series of experiments in which the velocity of the plate is either steadily increased or diminished. The result is formulated in relatively simple terms. R.Eisenschitz

539.893 : 548.33

809. POLYMORPHOUS TRANSFORMATIONS OF PHOSPHORUS AT VERY HIGH PRESSURES. V.P.Butuzov, S.S.Boksha and M.G.Gonikberg.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 837-840 (1956). In Russian.

A sensitive differential technique for recording the temperature change in a transformation has been applied to the study of the behaviour of black and red phosphorus at pressures of up to 12 000 atm and 1200°C. No new modification of black P was found; its m.p. under 18 000 atm is about 1000°C. A new modification of red phosphorus, with a small heat of transformation, was discovered at 4000 atm and about 600°C. R.C.Murray

539.893

810. PRODUCTION OF VERY HIGH PRESSURES WITH CONICAL PISTON DEVICE. L.F.Vereshchagin, A.I.Likhter and V.I.Ivanov.
Zh. tekh. Fiz., Vol. 26, No. 4, 874-7 (1956). In Russian.

By the use of conical rather than cylindrical pistons the problems of packing are avoided. An apparatus designed on this principle is built and tested. The highest pressure obtained is equal to 14 000 atm. R.Eisenschitz

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM. CHEMICAL REACTIONS 541.11/.12

541.123.2

811. GERMANIUM–OXYGEN SYSTEM. F.A.Trumbore, C.D.Thurmond and M.Kowalchik.
J. chem. Phys., Vol. 24, No. 5, 1112 (May, 1956).

Experiments are reported which indicate that the true eutectic temperature is 912 ± 5°C corresponding to equilibrium between Ge and tetragonal GeO_2. A phase diagram of the system Ge-GeO_2 is given. W.Good

541.123.2 : 539.155.2

812. STUDY OF THE BINARY EQUILIBRIUM BETWEEN HYDROGEN AND ITS ISOTOPES. R.Treviño Arizpe.
Rev. Mexicana Fís., Vol. 4, No. 1, 23-34 (Jan., 1956). In Spanish.

Graphs of liquid–vapour isobars, isotherms and concentration are given for H_2 – HD and H_2 – D_2, based on ideal solution theory. H.London

541.124 : 539.155.2

813. REACTOR FOR HD. I. THERMODYNAMIC PROPERTIES OF THE REACTION $H_2 + D_2 \rightleftharpoons 2HD$. J.R.Carrasco R.
Rev. Mexicana Fís. Vol. 4, No. 1, 35-51 (Jan., 1956). In Spanish.

For the purpose of designing a converter for decomposing HD into hydrogen and deuterium, nomograms and graphs are given for the equilibrium constant, heat of reaction and difference in specific heat and entropy, also equilibrium curves for the ortho–para equilibrium of H_2 and of D_2. The calculations are based on the data reported in Abstr. 1440 (1949). H.London

541.126

814. THEORETICAL PRE-EXPONENTIAL FACTORS FOR TWELVE BIMOLECULAR REACTIONS. D.R.Herschbach, H.S.Johnston, K.S.Pitzer and R.E.Powell.
J. chem. Phys., Vol. 25, No. 4, 736-41 (Oct., 1956).

The Arrhenius pre-exponential factor A has been calculated and compared with experiment for a group of twelve bimolecular gas phase reactions of simple inorganic molecules. The most detailed form of the activated complex theory, a cruder method of hydrocarbon analogy, and the simple collision theory were used. Necessary assumptions about the properties of the activated complex were made uniform for the whole set of reactions. Particular attention was paid to the treatment of internal rotations and vibrations. The agreement of the activated complex theory with experiment was found to be satisfactory. A.

541.126

815. ON THE PRESSURE ESTIMATION IN IMPACT SENSITIVITY EXPERIMENTS ON EXPLOSIVES AND THE PROBLEM OF INITIATION. M.P.Murgai.
J. chem. Phys., Vol. 25, No. 4, 762-7 (Oct., 1956).

Pressures generated on the explosive layer under conditions of experiments on the impact sensitivity of explosives have been calculated making use of the basic assumptions embodied in the Hertz theory of impact, taking data from certain experiments on explosion. In the absence of any knowledge of the elastic constants of explosives under dynamic conditions of loading, calculations have been made for two sets of elastic constants, one for steel to steel impact and the other for steel to a solid having elastic constants one-tenth that of steel. The experimental pressures lie between these two values. A reinterpretation of the results leads to a relation between a mass m and its height of h for 50% explosion efficiency. The conduction at the solid air interface due to an entrapped gas bubble compressed by these pressures has been considered. The amount of the explosive heated to the optimum temperature required for explosion, within times comparable to impact explosion delays, has been shown to be of the order of the hot spot size found from other considerations. The variation of the height h and the pressure p of the gas surrounding the explosive layer for 50% efficiency is shown to be governed by the relation h/p^2 = constant. A.

541.126

816. DETONATION PHENOMENA IN HOMOGENEOUS EXPLOSIVES. A.W.Campbell, T.E.Holland, M.E.Malin and T.P.Cotter, Jr.
Nature (London), Vol. 178, 38-9 (July 7, 1956).

In detonation fronts of liquid and solid explosives regions of low luminosity or "dark waves" are observed, which are larger and more numerous under conditions close to failure of propagation of detonation, but can also occur in normal constant-velocity detonations. Very thin metal foils can considerably reduce the diameter at which failure of nitromethane detonation occurs, and often completely prevent large dark waves, suggesting that the reaction zone is either very thin or that the foil allows the important first step of the reaction to occur undisturbed by edge affects. R.C.Murray

541.126.2

817. PROPAGATION OF LAMINAR FLAMES IN PREMIXED GASES. MEASUREMENTS AND THEORY OF FLAME SPEED. C.Franze and H.G.Wagner.
Z. Elektrochem., Vol. 60, No. 6, 525-56 (1956). In German.

A review of the definition of flame speed, and the difficulties of determining it from non-planar flames, methods of measuring flame speed, the variation of this speed with gas composition and other factors, and of treatments of the theory of flame speed. R.C.Murray

541.127

818. ON THE THEORY OF UNIMOLECULAR GAS REACTIONS: A QUANTUM HARMONIC OSCILLATOR MODEL. N.B.Slater.
Proc. Roy. Soc. Edinburgh A, Vol. 64, Pt II, 161-74 (1955).

The writer's theory of unimolecular dissociation rates, based on the treatment of the molecule as a harmonically vibrating system, is put in a form which covers quantum as well as classical mechanics. The classical rate formulae are as before, and are also the high-temperature limits of the new quantum formulae. The high-pressure first-order rate k_∞ is found first from the Gaussian distribution of co-ordinates and momenta of harmonic systems, and is justified for the quantum-mechanical case by Bartlett and Moyal's phase-space distributions. This leads to a re-formulation of k_∞ as a molecular dissociation probability averaged over a continuum of states, and to a general rate for any pressure of the gas. The high-pressure rate k_∞ is of the form $\nu e^{-F/\kappa T}$ where ν and F depend, in the quantum case, on the temperature T; but ν is always between the highest and lowest fundamental vibration frequencies of the molecule. Concerning the decline of the general rate k with pressure p at fixed temperature, k/k_∞ is to a certain approximation the same function of p as was tabulated earlier for the classical case, apart from a constant factor changing the pressure scale in the quantum case. A.

ELECTROCHEMISTRY 541.13

541.133

819. ON THE MECHANISM OF ELECTROLYTIC RECTIFICATION. D.A.Vermilyea.
J. appl. Phys., Vol. 27, No. 8, 963-4 (Aug., 1956).

The theory of the existence of a trapped ionic space charge to explain rectification is critically discussed. The hypothesis is put forward (and tested) that conduction through the oxide layer of the rectifier system, metal/metal oxide/electrolyte only occurs at singularities of some kind in the metal rectification resulting from the fact that the oxide formed over an inclusion in the metal is imperfect and has a high conductivity. W.Good

541.133.08

820. MEASUREMENT OF THE CONDUCTIVITY OF CONCENTRATED ELECTROLYTE SOLUTIONS USING A TRANSFORMER BRIDGE. R.Calvert, J.A.Cornelius, V.S.Griffiths and D.I.Stock.
Research Correspondence, Vol. 9, No. 4, S 16-S 17 (April, 1956).

The principles of the bridge are briefly described and a diagram of the conductivity cell (which has no internal electrodes) is given. The results of measurements on concentrated solutions of potassium bromide, ammonium chloride and calcium ferrocyanide are presented as graphs showing Λ as a function of $\sqrt{c}$. W.Good

541.135

821. DIFFERENTIAL CAPACITANCE OF ELECTROLYTES. J.R.MacDonald.
J. chem. Phys., Vol. 25, No. 2, 364-5 (Aug., 1956).

The author's explanation of the rapid increase observed in C^d with sufficiently negative potentials based on the assumption that the internal field causes solute ions to press against the inner layer and decrease its thickness is modified to include a "natural" field with the static internal field in the expression for dielectric saturation. Experimental evidence indicates that this "natural" field may be more important in methanol than in water, where saturation requires higher fields. W.Good

541.135

822. ON THE ELECTROLYTIC CONDUCTIVITY OF TRIPHENYLMETHYLCHLORIDE AND RELATED COMPOUNDS IN LIQUID SULPHUR DIOXIDE. W.Ilse and H.Hartmann.
Z. Naturforsch., Vol. 11a, No. 8, 630-2 (Aug., 1956). In German.

The authors show that the electrolytic dissociation of organic chlorine compounds in liquid SO_2 can be explained by the classical quantum theory. Conductivity measurements on tertiary chlorides in SO_2 solution are used to confirm their reasoning. W.A.Walker

541.135 : 538.614

823. THE ROTATION OF THE PLANE OF POLARIZATION IN ELECTROLYTIC SOLUTIONS BY A MAGNETIC FIELD. A.F.Kapustinskiĭ.
Zh. éksper. teor. Fiz., Vol. 29, No. 6, (12), 883 (1955). In Russian. English translation in: Soviet Physics JETP (New York), Vol. 2, No. 4, 744-5 (July, 1956).

It is demonstrated from experimental data that the molar rotation, ρ, is related to the frequency, ν, of the light by $\nu = A^{I}\rho^{1/2}$ for cations and by $\nu = A^{II}\rho^{1/2} + B$ for anions, where A^{I}, A^{II} and B are constants. W.Good

541.135.3

824. OVERVOLTAGES AND PASSIVITY IN MELTED ELECTROLYTES. R.Piontelli, G.Sternheim and M.Francini.
J. chem. Phys., Vol. 24, No. 5, 1113-14 (May, 1956).

The absence of overvoltage arising from exchanges at the electrode surface appears to be a general property at high enough temperature and with melted chloride baths for the metals Ni, Cu, Mg, and Al. Evidence is found of anodic passivity. W.Good

541.138.2

825. CONSTITUTION OF PHOTOGRAPHICALLY ACTIVE PARTICLES, EVOLVED DURING THE ATMOSPHERIC CORROSION OF METALS. I.L.Roikh.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 6, 1102-5 (1956). In Russian.

It is shown that the effect of powdered zinc on the surface of a photographic emulsion is very similar to the effect of hydrogen peroxide and it is suggested that the oxidation processes in the atmosphere produce hydrogen peroxide. J.M.Hough

PHOTOCHEMISTRY.

RADIATION CHEMISTRY 541.14/.15

541.14

826. VACUUM ULTRAVIOLET PHOTOCHEMISTRY. IV. NO AT 1236 A. M.Zelikoff and L.M.Aschenbrand.
J. chem Phys., Vol. 25, No. 4, 674-6 (Oct., 1956).

For Pt III, see Abstr. 4722 (1956). Dissociative recombination of NO^+ ions with electrons was shown to take place when NO is irradiated with krypton resonance radiation at 1236 A. Application of a d.c. voltage across the reaction cell produces an increased rate of decomposition by electron or positive ion bombardment of neutral NO molecules. A.

541.14

827. FORMATION OF FREE RADICALS IN POLYMER FILMS ON IRRADIATION. G.S.Egerton and S.L.Fitton.
Nature (London), Vol. 178, 41-2 (July, 1956).

Undyed dry films of cellulose acetate, nylon and methyl-methoxy nylon were exposed to u.v. light and to storage at 50°C. Heating or exposure to the light of a high-pressure mercury lamp in N_2 or O_2 resulted in either no changes or only slight changes in the absorption spectra. U.V. light of mainly $\lambda = 2537$ produced immediate changes which were increased on storage at normal and high temperatures. O_2 and N_2 influenced the action of u.v. on nylon only in the initial stages. Cellulose acetate showed a greater immediate change if exposed in N_2 than if exposed in O_2, whereas methyl-methoxy nylon showed the reverse effect. The conclusion drawn from the interpretation of these results is, that near u.v. or visible light do not form trapped free radicals in the polymers and that free radicals do not take part in the degradation of textiles exposed to sunlight filtered by ordinary glass. M.Ebert

541.144.8

828. PHOTOLYSIS OF DIMETHYL PEROXIDE. Y.Takezaki, T. Miyazaki and N.Nakahara.
J. chem. Phys., Vol. 25, No. 3, 536-42 (Sept., 1956).

Dimethyl peroxide has been photolysed in vapour phase by 2537 A light under various peroxide pressures at temperatures from 21 to 60°C, and for various light intensities at 30°C. The over-all rate was measured manometrically. The reaction is self-inhibiting and is also greatly inhibited by a small amount of formaldehyde. The initial rate is expressed by $AI + BI^{1/2}[CH_3OOCH_3]^{1/2}$ ($A \ll B$ and I is absorbed light intensity), and it tends to 3I when formaldehyde is added sufficiently. Carbon monoxide, methanol and formaldehyde were found in the reaction product. The amount of hydrogen was quite small in the normal run and also in the run where much formaldehyde was added. Based on these results the following mechanism has been proposed:

$$\begin{aligned} CH_3OOCH_3 + h\nu &\rightarrow 2(H + HCHO), \\ H + CH_3OOCH_3 &\rightarrow CH_3OH + CH_3O, \\ CH_3O + CH_3OOCH_3 &\rightarrow CH_3OH + CH_3OOCH_2, \quad (a) \\ CH_3OOCH_2 &\rightarrow CH_3O + HCHO, \quad (b) \\ CH_3OOCH_2 + CH_3O &\rightarrow CH_3OH + 2HCHO. \quad (c) \end{aligned}$$

From the temperature coefficient of the rate, $E_a + E_b - E_c = 5.8$ kcal, the difference of activation heats, has been obtained; the numerical value is supposed to be the upper limit of E_b. A.

541.15

829. ACTION OF Co^{60} RADIATION ON γ-HEXACHLOROCYCLOHEXANE AND CONSIDERATIONS OF RADIATION-SENSITIVITY. J.Duchesne, A.Monfils and J.Depireux.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 259-61 (July 16, 1956). In French.

The intensity of the 36.379 Mc/s quadrupole absorption of γ-hexachlorocyclohexane is diminished by Co^{60} γ-rays. The number of impurity centres is proportional to the dosage and 10^7 r halve the intensity with a 3 g sample. This is only 1/125 th the dose required to affect a similar change in p-dichlorbenzene. D.H.Whiffen

541.15 : 539.172.3

830. CHEMICAL EFFECTS OF THE $C^{12}(\gamma, n)C^{11}$ REACTION IN CARBONATES. W.J.Edwards and K.J.McCallum.
Canad. J. Chem., Vol. 34, No. 3, 189-92 (March, 1956).

After solution of the irradiated crystals, C^{11} was found to be present in the forms of carbonate, carbon monoxide, formic acid, oxalic acid, glyoxylic acid, and glycollic acid. The relative amounts of C^{11} appearing in each form agreed closely with those found previously for irradiations of solid sodium carbonate. A.

541.15 : 539.172.4

831. RECOMBINATION OF RECOIL FRAGMENTS IN NEUTRON-IRRADIATED POTASSIUM CHROMATE. A.G.Maddock and M.M.de Maine.
Canad. J. Chem., Vol. 34, No. 3, 275-83 (March, 1956).

The kinetics of the process whereby the retention increases on heating previously neutron-irradiated potassium chromate have been investigated. The results cannot be explained by any unimolecular or bimolecular mechanism, nor by a combination

of a few such steps. The data are not compatible with the commoner diffusion-controlled mechanisms. Experiments on solid solutions of potassium chromate in potassium fluoberyllate suggest that the process involves the recombination of the fragments from individual rupture events. A tentative hypothesis, analogous to the theory of the formation of very thin oxide films on metals, is advanced and it accounts for all the existing data. A.

541.15 : 539.172.4

832. CHEMICAL EFFECTS OF THE NUCLEAR TRANSFORMATION $N^{14}(n, p)C^{14}$. P.E.Yankwich.
Canad. J. Chem., Vol. 34, No. 3, 301-9 (March; 1956).

The physical and chemical behaviour of energetic carbon particles in ionic lattices is investigated. Models of the process due to Libby and to Seitz and Koehler are compared for simple and complex ionic crystals. For simple crystals the models lead to practically identical chemical predictions; where polyatomic ions are present, the Seitz—Koehler model appears to give a more satisfactory account of the distribution of radiocarbon over various product species. A.

541.15

833. A SEARCH FOR THE CHEMICAL EFFECTS OF INTERNAL CONVERSION FOLLOWING RADIATIVE NEUTRON CAPTURE. A.G.Maddock and M.M.de Maine.
Canad. J. Chem., Vol. 34, No. 4, 441-4 (April, 1956).

The possibility that neutron capture would lead to oxidation, because of internal conversion of the capture radiation, has been investigated in solid compounds of the lower valence states of antimony, arsenic, cerium, chromium, and thallium. Except in the hydrated compounds, negative results have been obtained. It is possible that oxidation is followed by electron-transfer exchange in the irradiated solids. A.

541.15

834. EFFECT OF GAMMA-RADIATION FROM RADIOACTIVE COBALT ON CARBOHYDRATES. M.A.Khenokh.
Dokl. Akad. Nauk SSSR, Vol. 104, No. 5, 746-9 (1955). In Russian. English translation in: Atomic Energy Res. Establ. (Harwell) Transl. No. 723, 4 pp. (1956).

Starch, inulin, fructose, saccharose, maltose, lactose, raffinose and glucose were exposed to Co^{60} gamma-radiation. The doses ranged from 80×10^3 r to 2700×10^3 r. Absorption spectra of the solutions were measured from 220 mμ to 300 mμ and the formaldehyde formed observed. It was found that all compounds showed increasing absorption at about 265 mμ and increasing formaldehyde formation with increasing radiation dose. Saccharose and raffinose were partially hydrolysed. M.Ebert

541.15

835. RADIOCHEMICAL DECOMPOSITION OF HYDRAZINE IN AQUEOUS SOLUTIONS. M.Lefort and M.Haïssinsky.
J. Chim. phys., Vol. 53, No. 6, 527-35 (June, 1956). In French.

Hydrazine in aqueous solutions is decomposed by gamma- and alpha-radiation and by H-atoms diffusing through a palladium foil. In vacuo gamma-radiation decomposes N_2H_4 according to $G(-N_2H_4) = 2\ G(N_2) = 2.2$. No H_2O_2, NH_2OH, nitrite or nitrate were found. This reaction is independent of pH for pH 0 to 10. Yields drop for higher pH. The yield was similar for irradiation in air-saturated solutions but in addition H_2O_2 was formed. At pH 9 and higher, autoxidation of N_2H_4 occurs and has a maximum at pH 12 giving a $G(-N_2H_4) = 20$. The reported alpha-ray yields for 2×10^{-3} M solutions were $G(-N_2H_4) = 1$; $G(N_2) = 0.55$; $G(NH_3) = 0.9$; $G(H_2O_2) = 0.4$; $G(H_2) = 1.65$; $G(O_2) = 0.2$. Authors investigated the effect of added H_2O_2 and of a change in initial concentration of N_2H_4. They conclude that OH radicals formed may either react with the substrate or form H_2O_2. H atoms diffusing through a palladium foil showed the same qualitative features as radiation produced H atoms. M.Ebert

541.15

836. EFFECT OF TEMPERATURE UPON THE CROSS-LINKING OF POLYETHYLENE BY HIGH-ENERGY RADIATION. R.M.Black.
Nature (London), Vol. 178, 305-6 (Aug. 11, 1956).

The number of cross links per 100 eV irradiation dose increases with temperature, from 0.5 to 3.0 over the range −190 to +75°C. The dependence on temp. is similar to the increased rate of degradation found in polyisobutylene (Abstr. 10038/1953), and in polymethylmethlacrylate (Abstr. 6972/1954). The process of energy absorption is believed to be independent of temperature, so that the dependence must arise in either (a) the subsequent dissociation with ion or radical formation or (b) when the excited radicals or ions interact giving stable cross links. J.H.Mason

DISPERSIONS. COLLOIDS. ADSORPTION 541.18

541.18.05

837. STABILIZATION AND COAGULATION OF COLLOIDAL SOLUTIONS WITH POLYELECTROLYTES. W.Heller and T.L.Pugh.
J. chem. Phys., Vol. 24, No. 5, 1107-8 (May, 1956).

Stabilization and coagulation of sols of iron and gold respectively by polyanions and polycations are described. The former is achieved at exceedingly low polyelectrolyte concentrations. An explanation is suggested. W.Good

CHEMICAL STRUCTURE 541.2/.6

541.62 : 533.15

838. SEPARATION OF HYDROCARBON ISOMERS BY THERMAL DIFFUSION. C.J.Danby, J.D.Lambert and C.M.Mitchell.
Nature (London), Vol. 177, 1225-6 (June 30, 1956).

As a result of recent work (Abstr. 8552/1955) on the transport properties of gaseous hydrocarbons it seemed likely that mixtures of hydrocarbon isomers might be separated by thermal diffusion. Experiments were performed on mixtures of n-pentane and neo-pentane in a concentric Pyrex tube thermal diffusion column, one metre long (inner wall 8 mm dia., temperature 300°C; outer wall 16 mm dia., at room temperature). The equilibrium separation factor is shown to be sensibly constant, over the whole range of concentrations examined, at a value a little over 2.0. H.C.Cole

541.651

839. ON A DEEP BLUE COMPOUND OF GOLD. H.Lux and T.Niedermaier.
Z. Naturforsch., Vol. 11a, No. 7, 613 (July, 1956). In German.

The deep blue colour obtained when gold is dissolved in molten KOH in an atmosphere of dry oxygen is shown to be due to a polynuclear complex anion in which the gold exists in two different valency states probably +1 and +3. W.Good

CHEMICAL ANALYSIS 543/545

545 : 537.311.33

840. A COMPARISON OF SOME METHODS FOR THE DETERMINATION OF TRACE IMPURITIES IN SEMICONDUCTORS. A.A.Smales.
J. Electronics, Vol. 1, No. 3, 327-32 (Nov., 1955).

The methods discussed are emission spectroscopy, mass spectroscopy (vacuum spark and isotope dilution), polarography, vacuum fusion, colorimetry and fluorimetry, the use of radioactive tracers and radioactivation (activating elements by neutron irradiation). The advantages and disadvantages of each method are mentioned. A.J.Mee

545.8 : 534.21

841. THE SONIC GAS ANALYSER. A.E.Martin.
Nature (London), Vol. 178, 407-8 (Aug. 25, 1956).

Refers to the successful development of a commercial form of sonic gas analyser by Dawes, Walton, Lawley and Mounfield. The principle of operation involves the use of two equal tubes (length d)each fitted with a deaf-aid earpiece at each end. At end A of each tube the "earpiece" is used as a sound source (3000 c/s) whilst at the opposite end B of each

tube the earpiece is used as a microphone. By electronic techniques it is easily possible to measure the phase difference of the sound arriving at the two receivers $B_1 + B_2$. This is zero when the gases filling the tubes are the same but becomes finite and measurable if one gas is heavier than the other. Expressions are given for the change of phase produced by any given gas mixture in one of the tubes — the gas in the other tube being regarded as "standard". No corrections for variations of pressure are involved and temperature compensation is easily arranged. A.B.Wood

CRYSTALLOGRAPHY 548

548.1

842. PACKING IN FRAMEWORK STRUCTURES.
W.T.Holser.
Acta cryst. Vol. 9, Pt 9, 764-7 (Sept., 1956).

The topology of framework structures as described recently by Wells (Abstr. 4165-7/1955) is considered in relation to packing coefficient. For stacked nets of regular polygons the packing decreases with the rank and proportion of the large polygon. In framework silicates, however, large polygons such as the 8-gons in feldspar are stable only in a collapsed form with diameter similar to 6-gons, and the resulting increase in packing may more than offset the topological effect. Four-connected silicate frameworks with packings appreciably greater than that of quartz are not likely. A.

548.24

843. TWINNING PROPERTIES OF LATTICE PLANES.
M.A.Jaswon and D.B.Dove.
Acta cryst., Vol. 9, Pt 8, 621-6 (Aug., 1956).

A novel crystallographic analysis is undertaken of atomic movements in deformation twinning of metals. Body-centred cubic metals, indium and mercury are treated in detail, and it is established that the operative twinning mode always involves the smallest possible homogeneous shear which could twin the lattice. An analogous criterion is developed for multiple lattices. A.

548.5

844. SPIRALS DEVELOPED ON SINGLE CRYSTALS OF COPPER BY HEATING TO HIGH TEMPERATURES IN HIGH VACUUMS. F.W.Young, Jr.
J. appl. Phys., Vol. 27, No. 5, 554 (May, 1956).

The Cu crystals were grown by the Bridgman method. Spirals centred on (111) poles, with 1μ steps, generally appeared after heating to 1050°C, but were not obtained on crystal spheres grown under conditions of carefully controlled cooling. J.Franks

548.5

845. FILAMENTARY GROWTHS ON METALS AT ELEVATED TEMPERATURES. S.M.Arnold and S.E.Koonce.
J. appl. Phys., Vol. 27, No. 8, 964 (Aug., 1956).

Small (1-2μ) filaments, detectable only in the electron microscope, formed in air, within the temperature range 200-700°C and after several hundred hours exposure, on the surfaces of 65/35 brass and 15 elements including the noble metals, are briefly reported. Some of the growths are believed to be oxides. S.Weintroub

548.5

846. EPITAXIAL GROWTH OF CRYSTALS OF HEXAGONAL SELENIUM. R.A.Hyman.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 687-8 (June, 1956).

The crystals were grown from the vapour phase under a reduced pressure of argon. The c-axes of the branching needles were found to be perpendicular to the c-axis of the spine or at 40° ± 3° to this axis. The misfits in the two cases are 14% and 25% respectively, these figures lying within the limits for epitaxial growth. W.Bardsley

548.5

847. CONDENSATION OF IRON AND PLATINUM ON CRYSTAL PLANES OF TUNGSTEN IN THE FIELD-EMISSION MICROSCOPE AT HIGH TEMPERATURES. K.Neubeck.
Z. Naturforsch., Vol. 11a, No. 7, 587-89 (July, 1956). In German.

The deposition by evaporation of various metals on a heated tungsten point leads to characteristic surface migration phenomena. The successive stages in the disappearance of deposited iron, as the temperature is raised, can be explained in terms of the differing activation energies for motion of atoms on different crystal planes. When platinum is deposited on tungsten, growth is observed to be particularly favoured on certain faces, in a manner previously found only for tungsten atoms on a tungsten surface. The participation of atoms of a different element in the growth of a surface is possible because the atomic radii of platinum and tungsten are almost equal. Further experiments indicated that most probably the continuation by foreign atoms of an incomplete crystal structure was being directly made visible in the field emission microscope, in spite of the fact that platinum has a face-centred cubic and tungsten a body-centred cubic lattice. V.E.Cosslett

548.5 : 537.311.33

DEFECTS IN GERMANIUM CRYSTALS GROWN FROM THE MELT. See Abstr. 374

548.52

848. GROWTH MECHANISM OF NEAR-PERFECT CRYSTALS. G.W.Sears and R.V.Coleman.
J. chem. Phys., Vol. 25, No. 4, 635-7 (Oct., 1956).

Direct evidence is presented to show that whisker growth by vapour deposition occurs at the tip rather than the base. Platelets are shown to grow at constant thickness by the action of a set of crossed-screw dislocations, and whiskers are shown to bear no screw dislocations normal to their axis. A.

548.52

849. GROWTH OF MERCURY PLATELETS FROM THE VAPOR. G.W.Sears.
J. chem. Phys., Vol. 25, No. 4, 637-42 (Oct., 1956).

A mechanism for the vapour deposition of mercury platelets is presented. The growth behaviour is accounted for on the basis of a single screw dislocation in a [110] crystallographic direction. The growth of whiskers versus platelets is determined by preferential nucleation of (100) or (110) planes on the active sites. A.

548.52

850. ON THE ORIGIN OF THE MICROSTRUCTURE IN ICE. A.L.Gentile and W.Drost-Hansen.
Naturwissenschaften, Vol. 43, No. 12, 274-5 (1956).

The development of a hexagonal microstructure in single crystals of ice, as observed by Truby (Abstract 785/1956), depends on the cooling and ageing of the ice, little or no structure appearing immediately after freezing. The microstructure is interpreted in terms of dislocations and it is postulated that dislocation rings are initially formed by the condensation of vacancies, and that further dislocations are produced by operation of Frank–Read sources by the stresses set up on cooling. A.B.Lidiard

548.55

851. DISORIENTATION OF SINGLE CRYSTAL SUBSTRATE DUE TO EPITAXIAL STRESS. A.Goswami.
Proc. Phys. Soc. B, Vol. 69, Pt 5, 583-4 (May, 1956).

During the anodic treatment of a single crystal of copper in an acidified halide solution (KBr) it was found that considerable disorientation of the copper surface was caused. This is interpreted as the relief of interfacial stress and affords evidence that the effect of such stress extends not only to overgrowths but also to the substrate surface and below this. W.Bardsley

548.55

852. BENDING OF SINGLE CRYSTALS OF SELENIUM. R.A.Hyman.
Proc. Phys. Soc. B, Vol. 69, Pt 7, 771-2 (July, 1956).

Suggests that the mechanical properties of single crystals of hexagonal selenium can be explained by assuming that the long spiral chains of selenium atoms fold back on themselves along neighbouring positions in the lattice. A.B.Lidiard

548.574

853. A SAMPLE ETCHING TECHNIQUE FOR REVEALING DISLOCATIONS IN SILICON. C.A.F.T.Spray.
Proc. Phys. Soc. B, Vol. 69, Pt 6, 689 (June, 1956).

The technique is described. The resulting pits are claimed to be at dislocations. One plate. W.Bardsley

ATOMIC AND X-RAY CRYSTALLOGRAPHY

548.7

548.7

854. ON ISOTOPIC EFFECTS IN LATTICES. J.Henry.
Bull. Acad. Roy. Belgique Cl. Sci., Vol. 42, No. 1, 51-62 (1956). In French.

The zero point energy of isotopic mixtures of diatomic crystals A B is studied. The zero point energy of a lattice A B — A* B where A and A* are isotopes, is shown to be higher than the zero point energy of a lattice containing only A or A*. This is done by expanding the free energy in powers of the differences of mass between the isotopes. Therefore a lattice A B A* B... should exhibit a phase separation into A B A B... and A* B A* B... at sufficiently low temperature. These considerations should apply to crystals like Li F in which some of the lithium atoms are replaced by their isotopes. This is the extension for diatomic lattices of the result previously obtained by I.Prigogine and his coworkers for monatomic lattices. A.

548.7

855. EFFECT OF DEFECTS ON LATTICE VIBRATIONS. II. LOCALIZED VIBRATION MODES IN A LINEAR DIATOMIC CHAIN. P.Mazur, E.W.Montroll and R.B.Potts.
J. Washington Acad. Sci., Vol. 46, No. 1, 2-11 (Jan., 1956).

For Pt I see Abstr. 792/1956. The normal modes of a linear diatomic chain of atoms of masses m and M interacting with nearest neighbour harmonic forces are analysed, and the effect of replacing one (or more) of the atoms by an "isotope" of mass m' is studied (the interactions remaining unaltered). Just as for the monatomic chain (Abstr. 792/1956) it is found that there are localized modes associated with such "defects". Formulae are given which describe the following effects: (1) when one of the lighter atoms m is replaced by an isotope $m' < m$, then a localized level (derived from the highest optical vibrational mode) appears above the optical band of frequencies; (2) if $m' > m$ this localized level appears in the energy gap between the optical and the acoustical band and is derived from the lowest optical vibrational mode; (3) when one of the heavier atoms M is replaced by a light isotope a localized level, derived from the highest acoustical mode, appears in the energy gap, while at the same time another localized level derived from the highest optical mode appears in the region above the optical band; (4) lastly, when an atom M is replaced by a heavier isotope there are no localized modes. The change in the zero-point energy of the chain is also calculated and explicit expressions are obtained for the two cases (a) $m \cong M$ and (b) $M \gg m$. The change in zero-point energy brought about by the incorporation of two isotopes depends on their separation, l; this enables an energy of interaction between them to be calculated. For large separations this is found to be proportional to l^{-3}; it is attractive for two light or two heavy isotopes, but repulsive for one light and one heavy isotope. A.B.Lidiard

548.7 : 536.421.1

856. AMPLITUDES OF THERMAL VIBRATION AT FUSION. J.J.Gilvarry.
Phys. Rev., Vol. 103, No. 6, 1700-4 (Sept. 15, 1956).

On the basis of theoretical results from the Debye—Waller theory of the thermal dependence of X-ray reflection intensity, relatively accurate values of the Lindemann constant are determined for ten metals by use of rigidity moduli at fusion with previously determined bulk moduli. Agreement of the derived value ρ of the critical ratio of root-mean-square amplitude of thermal vibration to nearest-neighbour distance at fusion, with the corresponding value from X-ray intensity data, is improved for the one case (Al) favourable for comparison. The average ρ over the body-centred cubic, face-centred cubic, and hexagonal lattice types is 0.11_1, in excellent agreement with the value 0.10_5 given by Grüneisen. Relatively accurate values of the Lindemann constant for Pb and Al imply that this quantity cannot be a strict constant over a lattice type; however, the assumption of an average over the lattice type yields an excellent approximation for the face-centred cubic elements. A.

548.7

857. AN X-RAY STUDY OF ORDERING PROCESSES IN CuAu SINGLE CRYSTALS. M.Hirabayashi and S.Ogawa.
J. Phys. Soc. Japan, Vol. 11, No. 9, 907-14 (Sept., 1956).

Ordering processes in the CuAu alloy were studied by X-rays using single crystals. Characteristic diffuse scattering effects, which may be regarded as similar phenomena to those in the partially ordered CoPt alloy, were observed at early stages of the ordering. The change in X-ray diffraction pattern during ageing was discussed on the basis of kinetics of the ordering reaction. A.

548.7

858. EFFECTS OF SUPEREXCHANGE ON THE NUCLEAR MAGNETIC RESONANCE OF MnF_2. R.G.Shulman and V.Jaccarino.
Phys. Rev., Vol. 103, No. 4, 1126-7 (Aug. 15, 1956).

The nuclear magnetic resonance pattern of F^{19} in single crystals of MnF_2 varied in the expected manner with crystal orientation for two non-equivalent F sites per unit cell. But the shift of resonance from ω/γ_F was much larger than the expected paramagnetic shift being 277 Oe instead of 7 Oe at 3660 Oe. The shift was proportional to the field and its large magnitude is ascribed to superexchange effects whereby the F atom effectively loses one of its electrons to the Mn^{++} to the extent of 2.5% so that the F atom is in the large field of its unpaired electron. D.H.Whiffen

548.7

859. SELF-ENERGY OF THE POLARON FOR INTERMEDIATE TEMPERATURES. T.Fulton.
Phys. Rev., Vol. 103, No. 6, 1712-14 (Sept. 15, 1956).

Approximate eigenvalues of the Fröhlich Hamiltonian, used as a model to represent the behaviour of the electron coupled to the optical modes of an ionic crystal, are obtained for temperatures at which there is an appreciable probability of real phonons being present in the field. The method used is an extension of the variational technique employed by Gurari to obtain the eigenvalues at absolute zero. Correlations between phonons are neglected. The results obtained indicate that an electron in equilibrium with the lattice will have a strongly temperature-dependent effective mass for intermediate temperatures. A.

548.7

860. ON THE FEYNMAN THEORY OF POLARONS. K.Yamazaki.
Progr. theor. Phys., Vol. 15, No. 5, 508-10 (May, 1956).

Feyman's theory is transcribed into a more conventional notation and an extension of the theory is indicated. P.T.Landsberg

548.7

861. ATOMIC FAULTS IN CRYSTAL STRUCTURE. A.Steinemann.
Schweiz. Arch. angew. Wiss. Tech., Vol. 22, No. 7, 226-37 (July, 1956). In German.

Precision measurements of a physical magnitude, when performed on different monocrystals of the same substance, give differing results. Generally the deviations are small, but important exceptions exist. A perfect crystal can only exist at absolute zero; at all other temperatures the thermal movement of the atoms produces certain faults in the lattice. Furthermore it is impossible to produce a crystal free of all foreign atoms. The paper reviews certain effects caused by defects of dimensions not exceeding a few atomic diameters. The already industrially important groups of semiconductors and luminescent materials are not here considered. T.P.Brody

548.7

862. A DETERMINATION OF THE RATIO OF THE EFFECTIVE CROSS-SECTIONS FOR THE CAPTURE AND RECOMBINATION OF OPTICAL ELECTRONS IN THE CRYSTAL PHOSPHORS ZnS-Cu, Co. Syuĭ Syuĭ-Yun.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 5, 818-21 (1956). In Russian.

The phosphor employed was ZnS-Cu(10^{-4}), Co (6×10^{-6}).

The ratio (σ_0/σ) of the cross-sections for recombination (σ_0) and trapping (σ) of free electrons was measured for electrons excited thermally, and excited optically by light of a wavelength of about 0.9 μ. The values found were (a) for optical excitation, $\sigma_0/\sigma \cong 2$, (b) for thermal excitation at 65° C, $\sigma_0/\sigma \cong 25$. The ratio of the latter value to that found previously at −140° C agrees with that deduced from a theory of trapping centres due to Pekar (Abstr. 5825/1950). J.M.Radcliffe

548.7

863. ELECTRICAL RESISTIVITY STUDY OF LATTICE DEFECTS INTRODUCED IN COPPER BY 1.25 MeV ELECTRON IRRADIATION AT 80°K. C.J.Meechan and J.A.Brinkman.
Phys. Rev., Vol. 103, No. 5, 1193-202 (Sept. 1, 1956).

The electrical resistivity change produced in copper by 1.25 MeV electron irradiation at 80°K has been measured. The recovery of this change upon annealing has been studied. A recovery state centred near room temperature exhibited a phenomenological activation energy of 0.60 ± 0.01 eV and obeyed a second-order chemical rate equation. It is proposed that this state is associated with the annihilation of interstitial atoms and vacant lattice sites resulting from interstitial migration. The present results are compared with those of other workers in an effort to understand the differences in the recovery of the electrical resistivity change produced by electron and cyclotron particle irradiation. A.

548.7

864. F-BAND OSCILLATOR STRENGTH DETERMINATION IN NaCl AND KCl. R.H.Silsbee.
Phys. Rev., Vol. 103, No. 6, 1675-80 (Sept. 15, 1956).

The F-band oscillator strengths in an X-irradiated NaCl crystal and an X-irradiated and an additively coloured KCl crystal have been determined by a new method. The density of centres is determined by measuring the intensity of the paramagnetic resonance of the centres. Expressing the results in the usual way, using Smakula's equation, gives f = 0.87 for NaCl and f = 0.85 for KCl. Some of the assumptions involved in the use of Smakula's equation are criticized. A.

548.7

865. ELECTRON BOMBARDMENT OF COUNTING DIAMONDS. K.Stratton and G.W.Dolphin.
Nature (London), Vol. 178, 208 (July 28, 1956).

Conductivity pulses decrease in magnitude with continued electron bombardment (15 MeV) due to formation of lattice defects which function as electron traps and reduce electron mobility. The effect of the bombardment is similar to that produced by neutrons and the diamonds acquire a bluish green tint. G.F.J.Garlick

548.7

866. ELECTRON TRAPS IN SILVER CHLORIDE. H.Kanzaki.
Phys. Rev., Vol. 99, No. 6, 1888-9 (Sept. 15, 1955).

Photographs are presented showing the distribution of "print-out" silver particles on the surface and in the interior of well annealed AgCl crystals. It is inferred that in such crystals there are electron traps at the points of emergence of edge dislocations at the surface, at the nodes in the dislocation networks inside the crystal and probably also at kink sites on the surface. A.B.Lidiard

548.7

867. AN APPROXIMATE CALCULATION OF ATTACHMENT ENERGIES FOR IONIC CRYSTALS. P.Hartman.
Acta cryst., Vol. 9, Pt 7, 569-72 (July, 1956).

Some formulae for an approximate calculation of electrostatic potentials at the surface of ionic crystals are given, based on previous work of Madelung and Kleber. It is concluded that for an infinite crystal the value of this potential is infinite when, parallel to the crystal face, layers of positive ions alternate with layers of negative ions. However, the attachment energy of neutral molecules for such faces is finite. The formulae are applied to sphalerite to calculate the attachment energies of molecules ZnS on (111), (110) and (001). These energies, expressed in units e^2/a (where a is the unit cell edge) are: $E_{111} = -2.583$; $E_{110} = -2.711$ and $E_{001} = -6.189$. A.

548.7 : 534.213

PROPAGATION OF ACOUSTIC WAVES IN CRYSTALS.
See Abstr. 175

548.7 : 536.413

THERMAL EXPANSION OF ALKALI HALIDE LATTICES.
See Abstr. 310

548.7 : 539.21

ACTION OF HIGH-ENERGY RADIATIONS ON SOLIDS.
See Abstr. 770

548.73/.74

868. DEBYE–SCHERRER DIAGRAMS OF THIN LAYERS. K.H.Olbricht and H.König.
Naturwissenschaften, Vol. 43, No. 10, 234 (1956). In German.

X-ray and electron-diffraction photographs of a silver layer 100 A thick are reproduced. The method of preparation of the specimen is described. A.R.Stokes

548.73/.74

X-RAY AND ELECTRON INVESTIGATION OF MATERIALS. See also under "Structure of solids". Decimal classification 539.26/.27

548.732

869. A NOTE ON THE DEBYE–WALLER THEORY. M.Blackman.
Acta cryst., Vol. 9, Pt 9, 734-7 (Sept., 1956).

The effect of temperature on the Bragg reflection from crystals is examined theoretically for a general crystal. It is shown that measurements of this effect can be used to obtain information about the vibrational spectrum of a crystal. A comparison is made of the existing data and the theoretical predictions. A.

548.732

870. THE X-RAY WAVE FIELD IN LARGE CALCITE CRYSTALS AND THE EFFECT OF DEFORMATION. G.Borrmann and G.Hildebrandt.
Z. Naturforsch., Vol. 11a, No. 7, 585-7 (July, 1956). In German.

A calcite crystal, 3 cm thick, showed abnormally large transmission when the Bragg condition was fulfilled, but the transmission dropped sharply when the crystal was deformed, e.g. by producing a temperature gradient. A.R.Stokes

548.733

871. A HIGH-TEMPERATURE MICRO-THERMOSTAT FOR X-RAY STUDIES ON SINGLE CRYSTALS OF APPRECIABLE VAPOUR PRESSURE. P.J.A.McKeown.
J. sci. Instrum., Vol. 33, No. 10, 386-8 (Oct., 1956).

A furnace is described to heat slightly volatile specimens up to 1250° C for experiments with an X-ray single-crystal spectrometer. The thermal expansion of alumina at right angles to its hexagonal axis is found to be $L/L_0 = 1 + 6.07_4 \times 10^{-6} T + 1.86 \times 10^{-9} T^2$, up to 1230° C. A.

548.733

872. A SIMPLE SCANNING MECHANISM FOR X-RAY DIFFRACTION. G.W.Smith and R.M.Hinde.
J. sci. Instrum., Vol. 33, No. 10, 391 (Oct., 1956).

A simple scanning mechanism is described for the X-ray investigation of preferred orientation in coarse-grained wires, by means of which the spottiness normally present in the diffraction patterns from such specimens is transformed into smooth variations of intensity on the Debye–Scherrer rings. The device is attached to a Unicam single-crystal goniometer and permits the non-repetitive scanning of a continuously rotating specimen. In its present form specimen lengths of about 5 mm can be scanned. A.

548.733

873. ON A PROPOSED DETECTOR FOR THE VISUAL OBSERVATION OF X-RAY DIFFRACTION IMAGES BY ELECTRONIC SCANNING. A.R.B.Skertchley.
J. Electronics, Vol. 1, No. 5, 487-92 (March, 1956).

The X-ray diffraction pattern is formed on the surface of a photoconductor (polycrystalline CdS) which is scanned by a moving electron beam. The reflected electron beam (which is modulated by the X-ray intensity) is amplified by a multiplier and displayed on a cathode-ray tube. The theoretical sensitivity of the device is discussed. A.R.Stokes

548.733 : 537.531

874. IMPROVED DEMOUNTABLE CRYSTALLOGRAPHIC ROTATING ANODE X-RAY TUBE. A.Taylor.
Rev. sci. Instrum., Vol. 27, No. 9, 757-9 (Sept., 1956).

An improved four-window demountable rotating anode X-ray tube fitted with rapidly interchangeable targets has been

constructed. Compactness equal to that of a standard sealed-off tube has been achieved by the use of an improved re-entrant vacuum seal and bearing assembly. By employing peripherally directed water-cooling in the anode behind the focal spot and a full-wave rectified high-tension supply, it has been possible to obtain greatly improved performance. With a copper target five inches in diameter rotating at 1000 r.p.m. and with a focal spot 8 x 0.5 mm, the continuous load at 50 kV was 120 mA without any signs of target erosion. A.

548.734

875. THE DETERMINATION OF ABSOLUTE CONFIGURATION BY THE USE OF AN INTERNAL REFERENCE ASYMMETRIC CENTRE. A.McL.Mathieson.
Acta cryst., Vol. 9, Pt 3, 317 (1956).

It is suggested that the absolute configuration of asymmetric centres in moderately complex compounds (20-50) atoms excluding hydrogen) might be determined by using, for X-ray analysis, a derivative which includes an asymmetric centre of known configuration e.g. if one lanostenyl iodochloroacetate diastereoisomer had been used instead of the iodoacetate derivative for the X-ray crystal analysis of the lanostenyl structure (Fridrichsons and Mathieson, J. Chem. Soc., 1953, No. 7, 2159, July) then the absolute configurations of the asymmetric centres could have been deduced whereas only the relative configurations were obtained. J.Iball

548.734

876. APPLICATION OF X-RAY IMAGE INTENSIFIERS IN CRYSTAL STRUCTURE INVESTIGATIONS. O.Brümmer and E.Morgenstern.
Naturwissenschaften, Vol. 43, No. 11, 248 (1956). In German.

Laue and Debye–Scherrer patterns were investigated using a medical-type electronic image intensifier. J.Adam

548.734.46 : 548.74

877. "STEREOSCOPIC" THREE-DIMENSIONAL STRUCTURE ANALYSIS. J.M.Cowley.
Acta cryst., Vol. 9, Pt 4, 399-401 (April, 1956).

A method has been devised for deriving plane sections of three-dimensional Patterson, potential or electron-density functions by a "stereoscopic" method from two or more two-dimensional projections corresponding to electron or X-ray diffraction patterns obtained with not very different orientations of the incident beam. The derivation of the three-dimensional Patterson function of basic lead carbonate serves as an example. A.

548.734.8

878. THE PROBABILITY DISTRIBUTION OF X-RAY INTENSITIES: ATOMS IN SPECIAL POSITIONS. A.Hargreaves.
Acta cryst., Vol. 9, Pt 2, 191-2 (Feb., 1956).

Explains why it is that in Hargreaves's derivation of the distribution for a structure containing heavy atoms in general positions (Abstr. 4189/1955), all reflections can be considered together; while in Collin's derivation for a structure with some atoms in special positions (Abstr. 9270/1955) the reflections must be divided into groups. A.R.Stokes

548.735

879. SYMMETRY TRANSFORMATIONS OF GENERAL ANISOTROPIC TEMPERATURE FACTORS. K.N.Trueblood.
Acta cryst., Vol. 9, Pt 4, 359-61 (April, 1956).

The effects of all possible crystallographic symmetry operations on general ellipsoidal atomic temperature factors are presented in tabular form. Examples of the application of these tables are given. A.

548.735

880. ANISOTROPIC TEMPERATURE VIBRATIONS IN CRYSTALS. I. DIRECT MEASUREMENTS OF DEBYE FACTORS FOR UREA. R.E.Gilbert and K.Lonsdale.
Acta cryst., Vol. 9, Pt 9, 697-709 (Sept., 1956).

Debye factors have been measured for 12 reflections of urea, from intensity measurements at 90, 293 and 370°K. The values of $(B^T - B^0)$, where B^0 is due to zero-point energy, thus obtained are distributed about curves of the type $A + B \cos^2\varphi$, but this approximation is, as expected, rather poor. If B^{293} values for these 12 reflections are calculated from Vaughan and Donohue's corrected data for urea, using their temperature factors for the individual atoms, the agreement is excellent. The Debye factors obtained by comparing the structure in thermal motion with the structure at rest at the same temperature ought not necessarily to be identical with the Debye factors which relate the thermally moving structure with one at rest at absolute zero. Reasons are given for believing that in the case of urea the atomic parameters change very little with temperature, but it is very desirable that structures should be determined accurately at more than one temperature, if possible. The importance of determining Debye factors at an early stage of structure refinement is emphasized. A.

548.735

881. ANISOTROPIC TEMPERATURE VIBRATIONS IN CRYSTALS. II. THE EFFECT OF CHANGES IN ATOMIC SCATTERING FACTORS AND TEMPERATURE PARAMETERS ON THE ACCURACY OF THE DETERMINATION OF THE STRUCTURE OF UREA. H.J.Grenville-Wells.
Acta cryst., Vol. 9, Pt 9, 709-21 (Sept., 1956).

The effects of changes in atomic scattering factors and temperature parameters on the atomic coordinates and R-factors obtained for urea are demonstrated. Re-calculation of the structure factors to be expected from Vaughan and Donohue's parameters shows that the value of $R = \Sigma\{|F_c| - |F_o|\} - \Sigma|F_o|$ is reduced from 0.099 to 0.061 when proper allowance is made for the anisotropic thermal vibrations deduced by them. The method used in making the calculations is described. Attention is drawn to the importance of separating thermal anisotropy from the bonding anisotropy implicit in directed scattering factors. New values of the temperature parameters and coordinates necessitated by the use of McWeeny's scattering factors are obtained from a least-squares refinement utilizing hk0 and h0l data only. These values lead to R(hkl) = 0.071. They have been used by Gilbert and Lonsdale for comparison with values of temperature factors obtained directly from X-ray measurements on 12 reflections at different temperatures, and are also compared with results obtained by neutron diffraction. The same coordinates give R(hkl) = 0.178 when used with an isotropic temperature factor. As a result of this work it is suggested that for accurate structure determination, anisotropic temperature factors should be introduced when $R \sim 20\%$, before any serious attempt is made to refine the atomic coordinates any further. Attention is drawn to the fact that two-dimensional refinement produced a value of $\sigma(\Delta F)$ for the three-dimensional data which is comparable with the probable experimental error $\sigma(F_o)$, thereby suggesting that further refinement might be unprofitable in this structure, and that three-dimensional refinement may be unprofitable in comparable structures unless extremely accurate intensities are obtained. A.

548.735

882. ANISOTROPIC TEMPERATURE FACTORS IN CUBIC CRYSTALS. K.Lonsdale and H.J.Grenville-Wells.
Nature (London), Vol. 177, 986-7 (May 26, 1956).

It is shown that the Debye factor for a cubic crystal can vary with order of diffraction if the thermal motions of different atoms are dissimilar: this explains observations by Weiss and others on α-brass (Abstr. 7831/1956). A.R.Stokes

548.735

883. THE DETERMINATION OF THE ANISOTROPIC THERMAL MOTION OF ATOMS IN CRYSTALS. D.W.J.Cruickshank.
Acta cryst., Vol. 9 Pt 9, 747-53 (Sept., 1956).

Equations are given for determining the anisotropic thermal motion of individual atoms in crystals by three-dimensional Fourier refinement methods. Simple approximations are indicated. An analysis shows that accidentally absent reflections can slow up the convergence of the refinement unless modifications are made. Formulae for the accuracy of the thermal parameter are given. A.

548.735

884. THE ANALYSIS OF THE ANISOTROPIC THERMAL MOTION OF MOLECULES IN CRYSTALS. D.W.J.Cruickshank.
Acta cryst., Vol. 9, Pt 9, 754-6 (Sept., 1956).

A method is given for determining the anisotropic rigid-body translational and rotational vibration tensors of molecules in crystals from the vibration tensors of individual atoms. A.

548.735 : 519.2

885. THE STATISTICS OF COMPLEX FUNCTIONS: APPLICATION TO CRYSTALLOGRAPHY. E.F.Bertaut.
Acta cryst., Vol. 9, Pt 5, 455-60 (May, 1956). In French.

The probability of a value of a given complex function and the joint probability of values of several given complex functions are written in a tractable form, and some applications to crystallography are discussed. The joint probability may be used in the determination of unknown phases of complex functions (e.g. structure factors) when the moduli (absolute values) are known by experiment. New criteria are developed which allow groups with and without centre of symmetry to be distinguished. A simple relation between phases, generalizing the Sayre–Cochran–Zachariasen relation in the centrosymmetrical case, is obtained. A method is indicated of finding the signs of invariant reflections (not depending on the choice of the origin) in groups without centre of symmetry. A.

548.735

886. ESTIMATES OF THE STANDARD DEVIATIONS OF THE OBSERVED STRUCTURE FACTORS AND OF THE ELECTRON DENSITY FROM INTENSITY DATA. J.A.Ibers.
Acta cryst., Vol. 9, Pt 8, 652-4 (Aug., 1956).

It is shown that an initial estimate of the standard deviation of the electron density may be obtained by a straightforward and relatively simple calculation based on estimates of the standard deviations of the observed structure factors. These latter estimates are readily obtained from the errors, observed and expected, in the intensity data. A.

548.735

887. ERRORS IN BOND LENGTHS DUE TO ROTATIONAL OSCILLATIONS OF MOLECULES. D.W.J.Cruickshank.
Acta cryst., Vol. 9, Pt 9, 757-8 (Sept., 1956).

Angular oscillations of molecules cause displacements of the electron-density peaks. A formula is given relating the displacements to the amplitudes of small angular oscillations. A.

548.735

888. ICOSAHEDRAL COORDINATION NUMBER 12. D.S.Martin, Jr, R.E.Rundle and S.A.Golden.
J. chem. Phys., Vol. 24, No. 5, 1114 (May, 1956).

An arrangement of twelve spheres with their centres at the vertices of a regular icosohedron gives a favourable packing arrangement. This is illustrated by reference to the structure of $La_2(SO_4)_3.9H_2O$. A.R.Stokes

548.735

889. NEW FORMULATION AND SOLUTION OF THE PHASE PROBLEM IN X-RAY ANALYSIS OF NONCENTRIC CRYSTALS CONTAINING ANOMALOUS SCATTERERS. Y.Okaya and R.Pepinsky.
Phys. Rev., Vol. 103, No. 6, 1645-7 (Sept. 15, 1956).

Use of anomalous dispersion in X-ray analyses of noncentric crystals reduces the problem of phase determination for any given structure factor to the choice between two possible roots of two simultaneous quadratic equations. This assumes that anomalous scatterer positions have been established by classical techniques. Selection of the correct root is aided by: the $P_S(u)$ function of Okaya, Saito and Pepinsky; heavy atom or isomorphous replacement techniques; or the linear inequalities of Okaya. Given moderately accurate structure factor amplitudes $|Fh|$ and $|F\text{-}h|$, the phase problem is solved for noncentric crystals containing anomalous scatterers; and the absolute configuration of the structure is obtained as a by-product of the direct analysis. A.

548.735

890. ERRORS DUE TO ABSORPTION IN DEBYE–SCHERRER PHOTOGRAPHS. P.Bellon, V.Scatturin and R.Zannetti.
Ricerca sci., Vol. 26, No. 6, 1732-42 (June, 1956). In Italian.

The dependence of the correction constant of the $\sin^2\theta$ values on the product μr (μ = linear coefficient of absorption, r = radius of the test piece), and on r, has been experimentally investigated for X-rays issuing from finite, exponential-type focal spots. It has been found that for μr values exceeding 1.5x this constant, and therefore the absorption errors at constant θ vary linearly with μr. It was found possible to determine correction factors for absorption errors, through calibration curves for powder chambers in apparatus of this type. A.

548.735.4 : 519.2

891. A THEORY OF PHASE DETERMINATION FOR THE FOUR TYPES OF NON-CENTROSYMMETRIC SPACE GROUPS 1P222, 2P22, $3P_12$, $3P_22$. J.Karle and H.Hauptman.
Acta cryst., Vol. 9, Pt 8, 635-51 (Aug., 1956).

Joint probability distributions and relevant expected values and variances are obtained for selected (but typical) non-centrosymmetric space groups belonging to the four types 1P222, 2P22, $3P_12$, $3P_22$. These lead to formulae for phase determination, the analysis and interpretation of which constitute the major goal of this paper. The analysis is strongly dependent on the theory of invariants and seminvariants, and the agreement between this theory and certain consequences of the probability theory is noteworthy. A.

548.735.4 : 518.5

892. ELECTROMECHANICAL CRYSTAL STRUCTURE FACTOR COMPUTER. N.T.van der Walt.
Rev. sci. Instrum., Vol. 27, No. 9, 750-6 (Sept., 1956).

An electromechanical device is described for computing the two-dimensional structure factor formulae,

$$\sum_{r=1}^{N} f_r \left\{ \begin{matrix} \sin \\ \cos \end{matrix} \right\} 2\pi h u_r \left\{ \begin{matrix} \sin \\ \cos \end{matrix} \right\} 2\pi k v_r \text{ and } \sum_{r=1}^{N} f_r \left\{ \begin{matrix} \sin \\ \cos \end{matrix} \right\} 2\pi(hu_r + kv_r).$$

f_r, u_r, v_r are fractional and may be fed in to the third decimal place; h and k may vary from −20 to +20. Each term in the series is computed individually to an accuracy of approximately $\frac{1}{2}\%$ and is automatically added to the existing sum whilst the next term is being computed. The speed of computation is generally equal to the speed with which the variables of each term are fed into the computer. The machine makes use of "magslip" resolvers for computation of the trigonometrical functions. A.

548.735.44

893. THEORETICAL AND EXPERIMENTAL STUDY OF THE TEMPERATURE FACTOR AND OF EXTINCTION IN ZINC BLENDE. A.Authier.
Acta cryst., Vol. 9, Pt 5, 411-16 (May, 1956). In French.

The coefficients of the dynamic Fourier matrix have been determined for a crystal of zinc blende, and the secular equation has been solved for the directions [100], [111] and [110]. In terms of two hypotheses two possible frequency distributions have been calculated. These both lead to values of the specific heat in good agreement with experiment, but give different values for the temperature factor. Absolute measurements with an ionization chamber of the intensities of reflection from a powder without extinction enable a choice to be made between the two frequency distributions. By comparing the intensities of the same reflections from two powders of known particle size, it is shown that zinc blende is a mosaic crystal and that the maximum size of the crystallite is 0.45μ. A.

548.735.44 : 548.737

894. STRUCTURE OF ACTIVATED AND SUGAR CHARCOAL BY THE COMPARISON OF THE CALCULATED AND EXPERIMENTAL ATOMIC DISTRIBUTIONS. H.Richter, G.Breitling and F.Herre.
Z. angew. Phys., Vol. 8, No. 9, 433-47 (1956). In German.

The method of Fourier analysis of the scattering curve is applied to X-ray photographs of activated and sugar charcoal. Cu K_α and Mo K_α radiation is used, with combined reflection and transmission of the X-rays. A method for the calculation of the structure is given by which the atomic distribution curve for finite, regular regions, and, if necessary, for disordered transition states, may be calculated. This distribution curve may be calculated for a number of structure models, and, by choice of the appropriate model, is made to coincide with the experimental curve. The "packet" structure of activated charcoal with irregular parallel layers in the flakes is confirmed by comparison with the established distribution curve. In the case of sugar charcoal, regular regions of about 7 A in extent are found to display the graphite structure. A.J.Mee

548.735.44

895. THE EVALUATION OF X-RAY LOW-ANGLE SCATTERING BY MEANS OF FOURIER ANALYSIS. V.Gerold; R.Hosemann.
Z. Elektrochem., Vol. 60, No. 4, 405-11, 412 (1956). In German.

The paper deals with the resolution of an apparent contradiction between the theories of Porod (Kolloid Zeitschrift, Vol. 124, 83, 1951) and Hosemann (Abstr. 7310/1953 and

11558/1954). The low-angle scattering due to a system of spheres occupying a spherical volume is calculated by both methods, and the difference is shown to be experimentally insignificant. The scattering by complementary systems is discussed. A note by Hosemann is added, on some limitations of Gerold's analysis. A.R.Stokes

548.735.7

896. CONICAL CRYSTALS OF GRAPHITE. T.Tsuzuku and T.Komoda.
Acta cryst., Vol. 9, Pt 1, 90 (Jan., 1956).

Observed under the electron microscope in artificial graphite, these circular crystals give spotty electron diffraction rings accompanied by ellipses and diffuse bands. This suggests that the crystal is a stack of thin graphite layers each rotated around the common c-axis and that each layer is not a plane disk but is slightly conical, like a lotus leaf. Such a crystal could be formed by a spiral mechanism. Gliding has been observed in these crystals. Six plates. W.Bardsley

548.736

897. DOUBLE REFLEXION IN ALUMINIUM–COPPER ALLOYS. J.M.Silcock.
Acta cryst., Vol. 9, Pt 1, 86 (Jan., 1956).

Two anomalous spots on single-crystal photographs of a two-phase alloy are attributed to the Renninger effect, i.e. the successive reflection of X-rays from two sets of planes. In this case one reflection is from the Al matrix and the other is from the θ' phase of the alloy. A.R.Stokes

548.736.1

898. THE CRYSTAL STRUCTURES AND LATTICE PARAMETERS OF HIGH-PURITY SCANDIUM, YTTRIUM AND THE RARE EARTH METALS. F.H.Spedding, A.H.Daane and K.W.Herrmann.
Acta cryst., Vol. 9, Pt 7, 559-63 (July, 1956).

The crystal structures and accurate lattice constants of scandium, yttrium and the rare-earth metals are given, and the values of their calculated mole-atomic volumes, densities, axial ratios and metallic radii are graphically compared. Expected variations due to the "lanthanide contraction" and structure differences are noted, and additional irregularities in the axial ratio and metallic radii plots are indicated. A.

548.736.3

899. ON THE ORDERED STRUCTURE PROPOSED FOR Li_3Mg_8. F.H.Herbstein and B.L.Averbach.
Acta cryst., Vol. 9, Pt 1, 91-2 (Jan., 1956).

The cubic structure proposed by Berry and Raynor (Nature (London), Vol. 171, 1078, June 13, 1953) is criticised on the grounds that its real symmetry is tetragonal, and that it involves an improbably large increase in mean volume per atom. Another structure is proposed in which interstitial atoms make up the required volume. A.R.Stokes

548.736.3

900. THE CRYSTAL STRUCTURE OF THE DEUTERIDES OF YTTERBIUM AND EUROPIUM. W.L.Korst and J.C.Warf.
Acta cryst., Vol. 9, Pt 5, 452-4 (May, 1956).

Ytterbium and europium have found to form deuterides which are isostructural with the hydrides of the alkaline earth metals. A.

548.736.3

901. THE CRYSTAL STRUCTURES OF SOME INTERMETALLIC COMPOUNDS OF PLUTONIUM. O.J.C.Runnals.
Canad. J. Chem., Vol. 34, No. 2, 133-45 (Feb., 1956).

The crystal structures of the following binary intermetallic compounds of plutonium are reported: $PuAl_2$, $PuAl_3$, $PuAl_4$, $PuBe_{13}$, $PuCo_2$, $PuFe_2$, $PuMn_2$, $PuNi_2$, $PuNi_5$, and Pu_2Ni_{17}. In addition, the unit cell dimensions are reported for $PuAg_3$. A.

548.736.4

902. THE STRUCTURES OF SOME FERRIC CHLORIDE–GRAPHITE COMPOUNDS. J.M.Cowley and J.A.Ibers.
Acta cryst., Vol. 9, Pt 5, 421-31 (May, 1956).

The ferric chloride–graphite system containing 55.5% ferric chloride has been examined by high-resolution electron-diffraction techniques and by X-ray powder photography. The system is found to consist of about 17% free graphite and about 83% of a ferric chloride–graphite compound. The complementary use of the two techniques allowed a detailed analysis of the structure of this compound. Single-crystal electron-diffraction patterns were used to determine the structures of the component layers. X-ray powder patterns served to confirm these results, and provided information on the stacking of the layers. It was found that single layers of ferric chloride are parallel and lie between successive parallel planes of carbon atoms. The c axis (normal to the layers) is 9.41 A. The translations of the layers relative to one another normal to the c axis are essentially random except that a partial coordination of chlorine and carbon positions gives rise to some short-range order. The ferric chloride layer, relative to a single layer is normal ferric chloride, is about 92% filled. The ferric chloride–graphite systems containing less than 55.5% ferric chloride are similar. As the percentage of ferric chloride decreases, the percentage of free graphite increases and the fraction of ferric chloride per ferric chloride layer decreases. At about 39% ferric chloride the layer stacking sequence in the c direction becomes random. A.

548.736.4

903. PROTON POSITIONS IN BRUCITE CRYSTALS. D.D.Elleman and D.Williams.
J. chem. Phys., Vol. 25, No. 4, 742-4 (Oct., 1956).

The proton positions in brucite have been determined by comparison of nuclear magnetic resonance spectra with existing X-ray data. The protons are located in parallel planes, in each of which the protons are arranged in a pattern having hexagonal symmetry. The distance between adjacent protons in a given plane is 3.12 ± 0.01 A, while the distance between a given proton and its nearest neighbours in the next plane is 1.93 ± 0.02 A. The distance between adjacent proton planes is 0.69 ± 0.02 A. The internuclear distance in the OH bond is found to be 0.98 ± 0.02 A. A.

548.736.5 : 536.413

904. THERMAL CHANGES IN THE STRUCTURE OF SODIUM SESQUICARBONATE. R.Candlin.
Acta cryst., Vol. 9, Pt 7, 545-54 (July, 10, 1956).

Accurate structure determinations of sodium sesquicarbonate in projection on (010) have been carried out at 18° C and -170° C, using intensities measured with a Geiger counter. Hydrogen atoms have been located at both temperatures. Changes with temperature of all interatomic distances and the angles between them have been inferred from the two-dimensional results, and the justification for this process is discussed. Anisotropic thermal vibrations are found for Na and H_2O, and their variation with temperature is examined. Results obtained for thermal expansion and electronic distribution in the three crystallographically distinct hydrogen bonds are compared with values for these quantities found in other structures. A.

548.736.5 : 539.133

905. A HYPOTHESIS OF THE COVALENT BOND CONFIRMED BY X-RAY SPECTROSCOPY. M.B.P.Vittorelli, M.U.Palma, D.Palumbo, M.Santangelo and F.Sgarlata.
Ricera sci., Vol. 25, No. 9, 2665-6 (Sept., 1955). In Italian.

The V = O bond in vanadium sulphate pentahydrate, indicated by magnetic resonance, is confirmed by bond-length measurement. A.R.Stokes

548.737

906. ON THE CRYSTAL STRUCTURE OF PARA DICHLOROBENZENE AT DIFFERENT TEMPERATURES. G.S.R.Krishna Murti and S.N.Sen.
Indian J. Phys., Vol. 30, No. 5, 242-9 (May, 1956).

The dependence of the structure of crystals of para-dichlorobenzene on temperature has been investigated by taking Debye–Scherrer photographs at different temperatures. It has been observed that the structure of the crystal is triclinic when the polycrystalline mass is kept at 40° C without ever allowing it to cool down below 40° C and this structure is identical with that reported by Jeffrey and McVeagh (1955) for the single crystal at 40° C. The transformation from triclinic to monoclinic system is observed to take place when the crystal at 40° C is cooled down to 28° C. It is pointed out that as the low-frequency Raman lines do not undergo any change with the change of structure these lines are not connected with the lattice. It has been further observed that in place of the two spacings, 1.882 A and 1.839 A, of the crystal at room temperature, only one spacing, 1.870 A, is shown by the crystal at -180° C and that the two spacings 4.282 A and 3.542 A of the crystal at room temperature increase respectively to 4.333 A and 3.616 A at -180° C, which indicates a slight increase in the length of the edge b of the unit cell at -180° C. It is pointed

out that this may be due to reorientation of the molecules at low temperatures and that the sharpening of the ultraviolet absorption bands observed by Swamy (1953) and the increase in the frequencies and number of the Raman lines observed by Ray (1951) with lowering of temperature of the crystal, may be connected with this reorientation of the molecules at low temperatures. A.

548.737

907. POLYMORPHISM OF PARA-DICHLOROBENZENE. C.Dean and E.Lindstrand.
J. chem. Phys., Vol. 24, No. 5, 1114-15 (May, 1956).

Evidence for a third crystal structure (γ) in para-dichlorobenzene containing one or two mole per cent of para-xylene is obtained from the shift in the pure quadrupole resonance frequency. G.Allen

548.74

908. NEUTRON DIFFRACTION STUDIES OF HAFNIUM–HYDROGEN AND TITANIUM–HYDROGEN SYSTEMS. S.S.Sidhu, L.R.Heaton and D.D.Zauberis.
Acta cryst., Vol. 9, Pt 7, 607-14 (July, 1956).

Results of neutron and X-ray diffraction studies on Hf and Ti hydrogen systems are reported. It is shown that the first single-phase hydride formed is a non-stoichiometric compound with a CaF_2-type structure. It deforms to a face-centred tetragonal structure as the composition approaches MX_2. From the crystal-structure data of these hydrides the positions of hydrogen atoms, the nearest-neighbour atoms and their interatomic distances are determined. It is indicated that the size of the "hole" for the hydrogen atom in the hydride is such that it must enter as an ion. The effect of metal–hydrogen bonds on the physical properties of hydrides, such as characteristic temperature and vibration frequency, is given. Evidence and explanation for the embrittlement of metals by hydrogen are offered. A.

548.74

909. ON THE SYSTEMATIC ABSENCE OF MAGNETIC REFLECTIONS OF NEUTRON DIFFRACTION. Y.-Y.Li.
Acta cryst., Vol. 9, Pt 9, 738-40 (Sept., 1956).

It is pointed out that the possession of reversal operations, by a magnetic lattice, causes the extinction of certain classes of magnetic reflections of unpolarized neutrons. Accordingly, the observation of systematic absences of magnetic reflections can be interpreted to identify the reversal operations involved. However, certain systematic absences of magnetic reflections are not caused by individual reversal operations. Neither are they trivial in the interpretation, nor do they have counterparts in the X-ray diffraction. The interpretation of the absence of the (h00)-type magnetic reflections and that of the absence of the (hk0) reflections are given in detail. The result is applied to analyse the Debye–Scherrer neutron diffraction of $ZnCr_2O_4$ at liquid-helium temperature. It may be concluded that on any cubic plane, whose normal is not in the direction of the sublattice magnetization, the 16 Cr ions within a magnetic unit cell divide themselves into two groups, each of 8; the moments in one group are opposite to those in the other. A.

548.74

910. THE USE OF THE STEREOSCOPIC TILT DEVICE OF THE ELECTRON MICROSCOPE IN UNIT-CELL DETERMINATIONS. J.A.Gard.
Brit. J. appl. Phys., Vol. 7, No. 10, 361-7 (Oct., 1956).

An improved method is detailed, making use of electron diffraction of individual crystals in the electron microscope, for determination of the unit-cell dimension most nearly parallel to the electron beam. A series of diffraction patterns is recorded from a crystal tilted through known angles by the device normally used for making stereomicrographs. One of these patterns serves as a datum, for location on each of the others of the centre of its almost circular Laue zones. A new method is described for calibration of the instrument without using additional apparatus; all the factors which vary with the electron-beam potential can then be derived from a single diffraction pattern of a standard substance. A graph has also been prepared to allow correction of errors in calculation due to large angles between the "third-row" axis and the electron beam. The improvement in accuracy due to the procedure is illustrated by results obtained using crystals of known unit cells. A.

548.74

911. A POSSIBLE SOURCE OF ERROR IN THE INTERPRETATION OF ELECTRON DIFFRACTION PATTERNS. G.D.Archard.
Brit. J. appl. Phys., Vol. 7, No. 10, 367-9 (Oct., 1956).

It is shown that a slight degree of preferred orientation of the crystallites in an electron diffraction specimen may be represented as the combination of two types of orientation which produce different kinds of distortion in the diffraction pattern. Unless special precautions are taken, these may lead to erroneous values of the Bragg angles deduced from ring radii. A.

548.74

912. ELECTRON DIFFRACTION PATTERNS OF CuO. J.M.Cowley.
J. appl. Phys., Vol. 27, No. 4, 422 (April, 1956).

A reply to a criticism made by Heidenreich and Storks (Abstr. 821/1956) of the author's explanation of anomalous electron diffraction intensities from CuO, which involves the presence of acicular crystals. Although anomalous intensities are observed by Heidenreich and Storks in the absence of such crystals the author points out that the other factors mentioned by him are well able to account for the observations. J.Thewlis

548.74

913. THE CUBIC FORM OF ICE. N.D.Lisgarten and M.Blackman.
Nature (London), Vol. 178, 39-40 (July 7, 1956).

Confirms by electron diffraction the existence of the cubic form of ice reported by König (Zeitschrift für Kristallographic, Vol. 105, 279, 1943). The transition temperature to the normal hexagonal form is, however, dependent on experimental conditions. The unit cell side, at $-130^{\circ}C$, is 6.351 ± 0.007 A. J.Thewlis

548.74 : 548.735.6

914. THE CRYSTALLOGRAPHIC ORIENTATION OF MINERALS BASED ON THEIR ELECTRON DIFFRACTION PATTERNS. O.E.Radczewski and H.Goossens.
Optik, Vol. 13, No. 7, 307-13 (1956). In German.

It is shown how a suitably equipped electron microscope can yield focused and defocused diffraction patterns of $1\ \mu^2$ areas selected from a given object. With the help of a selector diaphragm, various Bragg reflections can be singled out and made to produce dark-field images. From the combination of these, the orientation of small single crystals can be deduced. A.E.I. Research Laboratory

548.74

915. ON THE PROBABLE CONTRAST IN ELECTRON MICROSCOPE IMAGING OF CRYSTAL LATTICES. H.Niehrs.
Optik, Vol. 13, No. 9, 399-403 (1956). In German.

The author reconsiders the problem of the contrast from atoms and concludes that many of the assumptions made when considering a single atom as an object are difficult to justify. In practice, attempts at resolving atomic distances are made by examining small single crystals. The contrast to be expected from such crystals is considered. Using methods of the dynamic theory of interference, the intensity distribution from Mg-O crystals has been calculated. The result shows that no difficulties of contrast should arise provided that high enough resolving power is available. The visibility of the atoms should increase with resolving power. The usual definition of contrast is not relevant to this question since there is an amplification of intensity at the atom sites over that from the primary beam. It is necessary to choose a suitable crystal thickness and orientation. A.E.I. Research Laboratory

GEOPHYSICS 55

550.341 : 538.566

SOLUTION OF AN INTEGRAL EQUATION OCCURRING IN IMPULSIVE WAVE PROPAGATION PROBLEMS. See Abstr. 553.

550.371

916. THE ELECTRICAL CHARGE OF THE EARTH. J.A.Chalmers.
J. atmos. terrest. Phys., Vol. 8, No. 1-2, 124-5 (Feb., 1956).

A discussion of the conclusions of Clark and Kraakevik (Abstr. 10097/1955); in particular the charge conveyed to the earth by a thunderstorm is considered to be much smaller than they suggest. J.M.Hough

550.372

917. ELECTRICAL RESISTIVITY OF METEORITES. J.F.Evernden and J.Verhoogen.
Nature (London), Vol. 178, 106-7 (July 14, 1956).

The resistivity of several stony meteorites containing a variable amount of metal was obtained from specimens cut in the shape of square prisms with a cross-section of about 1.7 cm^2 and not shorter than 2.5 cm. Measurements on different specimens from the same stone sometimes differed by nearly one order of magnitude. The results show that the resistivity of these meteorites differs by several orders of magnitude from that of the silicate phase and is not proportional to the metal-phase content. The material is also probably not isotropic with respect to resistivity. It is considered that the rapid rise in conductivity at depths between 600 and 900 km could be explained by textural changes and that the electrical properties offer no clue to the precise metal-phase content at these depths. It is considered that the low resistivity of the mantle below 900 km is essentially that of the silicate phase. The presence of metallic channels which so largely affect the electrical conductivity under ordinary conditions have little effect on the thermal conductivity as the ratio of the metal and silicate phases is of the order 10^2-10^3. R.S.Read

550.372

918. AN EVALUATION OF TWO RAPID METHODS OF ASSESSING THE THERMAL RESISTIVITY OF SOIL. M.W.Makowski and K.Mochlinski.
Proc. Instn Elect. Engrs, Paper 1942 M, publ. Dec., 1955 (Vol. 103 A, 453-70).

Republication, with discussion, of the paper abstracted in Abstr. 1757 (1956).

550.378

919. CORRECTION FOR THE EFFECT OF COSMIC RADIATION ON FIELD MEASUREMENTS OF THE RADIOACTIVITY OF SOILS. G.J.McCallum.
New Zealand J. Sci. Technol. B, Vol. 37, No. 2, 172-8 (Sept., 1955).

The background count rate in the apparatus used for soil radioactivity measurements in the field is analysed. A formula for calculating the intensity of the cosmic-ray background under conditions of varying depths of soil, soil densities, and barometric pressures is developed, and an estimate made of the count rate to be expected from given concentrations of potassium, uranium and thorium. A.

550.38 : 523.76 : 538.3 : 532.51

920. HYDROMAGNETIC DYNAMO THEORY. W.M.Elsasser.
Rev. mod. Phys., Vol. 28, No. 2, 135-63 (April, 1956).

In this detailed survey of recent theories, the basic equations of magnetohydrodynamics are derived and applied to the problem of the generation and maintenance of terrestrial, solar and stellar magnetic fields. Special attention is given to dynamo actions based on motions which are stationary in the mean rather than rigorously stationary, and the role is emphasized of Coriolis forces in producing the low degree of symmetry in three-dimensional motion necessary for the existence of dynamo action. A detailed discussion of the motion of the earth's liquid core and its relation to the terrestrial field is given, and the possibility of field reversals is also considered. R.A.Newing

550.383

921. SUPPLEMENTARY NOTES ON ANOMALOUS BEHAVIOR OF TRANSIENT CHANGES IN GEOMAGNETIC Z-COMPONENT AS OBSERVED IN CENTRAL JAPAN. I.Yokoyama.
Rep. Ionosphere Res. Japan, Vol. 9, No. 2, 115-16 (1955).

Continuous observations over July-September, 1954, in Ooshima Island show that this region is subject to variations of the vertical geomagnetic component of anomalously large amplitude, similar to that previously reported for other parts of Japan. G.M.Brown

550.384

922. ON THE THEORY OF SOLAR ECLIPSE EFFECTS IN EARTH'S MAGNETIC FIELD. H.Volland.
J. atmos. terrest. Phys., Vol. 9, No. 2-3, 131-43 (Aug.-Sept., 1956).

The deformation of the S_q current during a solar eclipse is represented by a current function S_e, which is superposed on the S_q system and moves with the eclipse. The magnetic field components of S_e are computed, and the influence of the part induced in the earth's crust is discussed. A.

550.385 : 523.745

923. GEOMAGNETIC ACTIVITY AND SOLAR M-REGIONS FOR THE CURRENT EPOCH OF THE SUNSPOT MINIMUM. J.N.Tandon.
Indian J. Phys., Vol. 30, No. 4, 153-68 (April, 1956).

The analysis of geomagnetic activity has been made for the period 1950-54 and four sequences of annual variations have been detected. It has been shown that the most predominant effect of M-regions is observable only on particular dates separated at an interval of 27 days. In the last section the possibility of the association of M-regions with various solar features has been discussed and it is found that they can be identified with unipolar magnetic regions which may also be the seat of low coronal line intensities. A.

550.385

924. TWO TYPES OF THE GEOMAGNETIC DISTURBANCE. Y.Sekido.
Rep. Ionosphere Res. Japan, Vol. 9, No. 3, 182 (1955).

Geomagnetic storms have been classified into (a) those associated with a decrease of cosmic-ray intensity (S-type), and (b) those not so associated (M-type), and the relationship of both types to sunspot activity is considered. G.M.Brown

550.386 : 523.74

925. SOLAR Hα FILAMENTS AND GEOMAGNETIC DISTURBANCES. H.I.Leighton and D.E.Billings.
J. atmos. terrest. Phys., Vol. 7, No. 6, 349-50 (Dec., 1955).

A tendency is found for the filamentary area at the solar central meridian to be a minimum for 2-3 days prior to the onset of geomagnetic activity. This result conflicts with the suggestion of Kiepenheur (1947) that recurrent M-region activity is always associated with dark filamentary areas on the solar disk. D.R.Barber

550.389 : 551.510.535

926. EFFECT OF ALTITUDE ON THE POSITION OF THE MAGNETIC POLE. J.A.Jacobs.
Nature (London), Vol. 178, 35-6 (July 7, 1956).

Values of the Northerly (X) and Easterly (Y) components of the earth's magnetic field were calculated for a spheroidal earth at heights of 100 and 250 km corresponding to the E- and F-layers of the ionosphere and for different values of the co-latitude and longitude. The calculations were repeated on a much finer grid to trace any movement of the magnetic pole with increasing height. The tabulated results show a gradual shift in the position of the magnetic pole with increasing altitude. At 250 km the pole was moved 1° northwards. In certain cases H increases with height due mainly to increase of X. Probably this reflects small errors in the coefficients of harmonic expansion but less probably it could be due to currents in the ionosphere. R.S.Read

550.42 : 523.5

927. ABUNDANCES OF THE ELEMENTS. H.E.Suess and H.C.Urey.
Rev. mod. Phys., Vol. 28, No. 1, 53-74 (Jan., 1956).

The paper discusses in detail elemental abundances in terrestrial, and meteoritic sources; and provides a tabulated list of all atomic abundance values (referred to Si = 10^6), including recent data on the rarer elements. Consideration is given to the problems of interpreting correctly the nuclear abundance distribution from the standpoint of the origin of elemental matter; and attention is directed to evidence which may lead to some indication of the nature of the last nuclear reaction prior to establishment of the present abundance distribution, and to a knowledge of the condition under which this reaction took place. D.R.Barber

550.93

928. THE AGE OF THE EARTH FROM LEAD ISOTOPE ABUNDANCES. R.D.Russell and D.W.Allan.
Monthly Not. Roy. Astron. Soc., Geophys. Suppl., Vol. 7, No. 2, 80-101 (Oct., 1955).

Methods of using isotopic abundances of dated common lead samples to obtain the time since which the earth's upper mantle has preserved heterogeneities in its composition are reviewed. This time has often been referred to as the "age of the earth". Several modifications of these methods are sug gested. The measured abundances of eighty young lead ores are examined in detail, and it is concluded that the age of the earth is 4.3 x 10^9 years. A.

551.46

929. WATER BALANCE OF CONTINENTS AND OCEANS. L.I.Zubenok.
Dokl. Akad. Nauk SSSR, Vol. 108, No. 5, 829-32 (1956). In Russian.

The publication of Vol. II of the Marine Atlas (Moscow) enables a new study to be made. Details are given for the separate continents and oceans and a satisfactory balance is obtained for the globe as a whole. J.M.Hough

ATMOSPHERE. METEOROLOGY 551.5

551.508.21

930. THE UVIOMETER, AN ACTINOMETER CONSTRUCTED BY T.E.AURÉN. N.Rodskjer.
Ark. Geofys., Vol. 2, Paper 16, 377-84 (1955).

Expressions are obtained for the radiation received per unit area of the absorbing bands of the instrument in terms of the measured voltage and current and the temperatures of the air and the bands. The results of a calibration are tabulated and the influence of temperature on the calibrations shown graphically. A comparison with an Ångstrom compensation pyrheliometer was made to cover different altitudes of the sun and various degrees of turbidity of the air and the results are tabulated. For measurements of the total and filtered direct solar radiation and the uviometer is found to have an accuracy quite sufficient for meteorological purposes. R.S.Read

551.508.23

931. THE AURÉN SOLARIMETER. N.Rodskjer.
Ark. Geofys., Vol. 2, Paper 17, 385-93 (1955).

In this instrument the incident radiation is diffused by an opal glass plate and received on a blackened circular copper plate below it with the warm junctions of a thermopile attached to its under side. The cold junctions are in the air about 1.5 cm below the copper plate. The construction and results of laboratory tests are given. The determination of the reduction factor and selective sensitivity of the instrument are described. The reduction factor will in general depend on the mutual proportions of the radiation from the sun, clear sky and clouds and temporarily on the position of the clouds in the sky. A constant reduction factor for the solarimeter would on some occasions lead to considerable errors in the evaluated incoming solar radiation. It is considered that from a comparison between the solarimeter and a pyranometer with well known characteristics simple relations could be derived between the reduction factor, cloudiness and solar height by which the insolation may be obtained with fairly good accuracy. R.S.Read

551.508.71

932. MEASUREMENT OF THE HYGROMETRIC STATE OF GASES BY MEANS OF HYGROMETRIC RESISTANCES. J.Coulon and G.Gayrard.
C.R. Acad. Sci. (Paris), Vol. 243, No. 6, 573-5 (Aug. 6, 1956). In French.

The method already outlined for the measurement of atmospheric humidity (Abstr. 6262/1956) is modified for gases whose moisture content is small, by treating the surface of the prepared hygrometric resistance (clay slate) with a dilute solution of a lithium halide of known concentration, and fixing the salt on the surface by heating the resistance in an electric furnace. Exposure of the resistance to a gas ultimately produces dew on its surface and thereby enhances conductivity, whose value at the appearance of the dew affords a measurement of the humidity of the gas. The influence of temperature is negligible in the region of 30° C. H.H.Hodgson

551.508.91 : 551.574.1

933. SOME CONSTRUCTIONAL DETAILS OF A PHOTO-ELECTRIC CONDENSATION NUCLEUS COUNTER. R.Siksna.
Geofis. pura appl., Vol. 31, No. 2, 9-20 (1955). In German.

Details of the construction of a photoelectric nucleus counter are described. The operation of the counter is electrified and is carried out by electromagnetic valves. Special humidifiers are used. Visual observation of the fog formation phenomena in the absorption tube is introduced. A condenser for sifting the charged nuclei is built in, which can be simply converted into a counter for large ions. As an accessory a camera is provided so that the counter can be used as a combined photoelectric and photographic condensation nuclei counter. A.

551.508.91 : 551.574.1

934. ON THE FOG FORMATION IN THE PHOTO-ELECTRIC COUNTER. T.Murphy.
Geofis. pura appl., Vol. 31, No. 2, 26-31 (1955).

The operation of a photoelectric nucleus counter has been examined in detail to investigate the causes of uncertainties in the readings with a photographically recording galvanometer. Various peculiarities are pointed out and it is suggested that these are the result of deposition of fog droplets on the glass closing plates and limit the accuracy of a counter to about 5%. Unsuccessful attempts to eliminate this deposition are given and the possibility of solution is offered by reverting to a different form of fog chamber. A.

551.508.91 : 551.574.1

935. A PHOTO-ELECTRIC NUCLEUS COUNTER WITH SIZE DISCRIMINATION. T.A.Rich.
Geofis. pura appl., Vol. 31, No. 2, 60-5 (1955).

A variation of the Nolan—Pollak photoelectric nucleus counter for size discrimination is described. Instead of applying an over-pressure, the sample in fog-tube of the new instrument starts at atmospheric pressure and expands into two evacuated containers. The expansion into the first container is as rapid as possible and this determines the maximum supersaturation. The expansion into the second is slow enough to permit the growth of water drops to limit the supersaturation below the initial value, and yet fast enough for the expansion to be essentially adiabatic. The calibration is essentially the same as long as the sum of the two volumes is constant, and only those particles smaller than the size determined by the initial supersaturation contribute to the reading. A.

551.509.67

936. THE DECAY OF THE ICE-NUCLEATING PROPERTIES OF SILVER IODIDE RELEASED FROM A MOUNTAIN TOP. E.J.Smith and K.J.Heffernan.
Quart. J. Roy. Meteorol. Soc., Vol. 82, 301-9 (July, 1956).

Silver-iodide freezing nuclei, together with a tracer of zinc-sulphide particles, were released from a mountain top and detected in an aircraft. The ice-nucleating properties of the silver iodide decayed in the daytime but not at night. The ambient temperature did not appear to affect the daytime rate of decay. The top of the smoke plume rose no higher than in previous experiments when it was released from a flat plain. A.

551.510.41 : 523.78

937. ELECTROPHOTOMETRIC STUDIES OF THE ATMOSPHERIC OZONE DURING SOLAR ECLIPSES OF 25 FEBRUARY, 1952 AND 30 JUNE, 1954. Sh.A.Bezverkhniĭ,

A.L.Osherovich and S.F.Rodionov.
Dokl. Akad. Nauk SSSR, Vol. 106, No. 4, 651-4 (1956). In Russian.

Measurements of solar radiation in five sectors of the spectrum (with transmission band maxima at 3140, 3200, 3400, 3600 and 3900A) were carried out by means of integral electrophotometers with Sb-Cs cells and photomultipliers. A sharp increase of the proportion of ozone was detected during the stage of complete eclipse. This is consistent with the values of the Q_s/Q_2 ratio (amount of the ozone-generating and ozone-decompositing radiation, respectively), calculated on the basis of Chapman's theory and Wulf and Deming's equation.

F.Lachman

551.510.41

938. NOTE ON THE VARIATIONS OF ATMOSPHERIC OZONE AS A FUNCTION OF HEIGHT. E.S.Epstein, C.Osterberg and A.Adel.
J. atmos. terrest. Phys., Vol. 8, No. 6, 347-8 (June, 1956).

The vertical distribution of ozone between the ground and higher levels has been obtained from a ground station (Flagstaff, Arizona) by a new method from its absorption and radiation. Monthly means for the period Feb.- Aug. 1955 were extracted and shown on a graph. These show a remarkable similarity to those obtained by Paetzold (in Europe) in spite of the differences of latitude and longitude between the two locations. The same spring maximum is shown, a summer maximum above 32.5 km but a month or two later than in Europe, and a transitional zone at 21.25-27.5 km but lower than in Europe.

R.S.Read

551.510.534

939. AN EXPERIMENTAL INVESTIGATION OF THE 9.6μ BAND OF OZONE IN THE SOLAR SPECTRUM. C.D.Walshaw and R.M.Goody.
Quart. J. Roy. Meteorol. Soc., Vol. 82, 177-86 (April, 1956).

Mean heights of atmospheric ozone derived from two years' observations of the 9.6 μ vibration—rotation band are discussed. In each year there is a seasonal trend with a minimum mean height in summer and an annual range of 3.4 km. Careful consideration of sources of systematic errors shows that this result is probably due to changes in the ozone distribution, and a plausible seasonal cycle of changes of the ozone concentration in the troposphere and lower stratosphere is discussed. No other significant result is obtained and there is very little residual variance available for correlation with other meteorological phenomena.

A.

551.510.535

940. IRREGULARITY AND REGULARITY OF THE SPORADIC E-LAYER. K.Rawer.
Geofis. pura appl., Vol. 32, No. 3, 170-224 (1955). In German.

From station observations much information on top-frequency fEs, less on blanketing frequency fbEs is obtained. The results must be interpreted in statistical terms. Time- and distance-correlation functions are established. Daily, seasonal and geographic regularities are discussed. A sharp maximum exists at the magnetic equator but only for the top-frequency. No well defined influence of the solar cycle has been found, only a very weak one of lunar tides. Apart from the routine evaluation observations of the variation of the reflection coefficient with frequency have been made. In temperate latitudes in about 1/3 of all cases there is no partial reflection; in the other cases local variations of electron concentration up to 1 : 2 are found, higher values are rare. At low latitudes the variation may be more important. This is found by a qualitative classification of ionograms of different stations. Such classification has been made for transparency, scatter, angle of incidence and layer development. Diffuse echoes exist often near the magnetic equator. Es is always vertically sounded at temperate latitudes. In most cases the ionization originates as a thin layer of constant altitude. Transitory phenomena coming downwards are responsible for "E2s" in daytime. It appears that a cumulo-cirrus-cloud layer is a good model for Es-ionization. An atmospheric ionization process using stored energy from dissociation or ion existence seems to be most probable.

A.

551.510.535

941. IONOSPHERIC PREDICTION METHODS AND THE PROBABLE SOURCES OF ERROR. S.S.Baral.
Indian J. Phys., Vol. 30, No. 4, 189-205 (April, 1956).

The various sources of error in the prediction of foE, foE_1, foE_2 and (M 3000) F_2 are discussed. It is shown that the deviations of the foE and medium-latitude foE_1 predictions are to be ascribed to inaccuracy in sunspot number prediction. The deviations of high and low latitude foF_1 predictions are to be ascribed to deviation from $\sqrt[4]{(\cos \chi)}$ law. Deviations of foF_2 and (M 3000)F_2 predictions are caused by the insufficient knowledge of the diurnal and seasonal trends of these parameters. Interpolation errors of foF_2 and (M 3000)F_2 are due to incomplete knowledge of the geographical distribution of these parameters. The law of geomagnetic control, on which the predictions are based, is different for different hours of the day. For instance, during equinox months, the geomagnetic latitude distribution of foF_2 values shows a cusp near the geomagnetic equator for hours for which the F-layer is separated into F_1 and F_2 and a single maximum near the geomagnetic equator for hours for which the layer is not so separated. It has been found that the inaccuracy in MUF prediction cannot be completely accounted for by the inaccuracies of fo and M predictions taken together. Study of the day to day dispersion of foF_2 values from their monthly median shows that the dispersion is low for low values of the solar zenith angle. No such generalization can, however, be made in the case of the dispersion of (M 3000)F_2 values.

A.

551.510.535

942. THE MEASUREMENT OF NORMAL E-LAYER CRITICAL FREQUENCIES AT NIGHT. W.R.Piggott.
J. atmos. terrest. Phys., Vol. 7, No. 6, 341-2 (Dec., 1955).

Night-time h'f patterns do not show the typical group retardation effects for the normal E-layer and the critical frequency cannot be identified. It appears that night-time measurements of the variation of absorption with frequency (and with time on a fixed frequency) can be used to identify the absorption band associated with the critical frequency, and allow determination of the latter with considerable accuracy. Such measurements at Slough have indicated a variation with time fitting a recombination law with a coefficient of 10^{-8} cm^3 sec^{-1}.

G.M.Brown

551.510.535

943. ON THE LEVEL AT WHICH FADING IS IMPOSED ON WAVES REFLECTED VERTICALLY FROM THE IONOSPHERE. H.G.Booker.
J. atmos. terrest. Phys., Vol. 7, No. 6, 343-4 (Dec., 1955).

Comparison with theory of the experimentally determined auto-correlation function over the ground of the field of a downcoming wave from the ionosphere shows that the irregularities causing the fading occur at a level where the ionization density is within a few per cent of the critical value required for classical reflection. Such scattering in or near the reflecting stratum may return as much energy as reflection itself.

G.M.Brown

551.510.535

944. THE RECOMBINATION COEFFICIENT IN THE E-LAYER DURING AURORAE. A.Omholt.
J. atmos. terrest. Phys., Vol. 7, No. 6, 345-6 (Dec., 1955).

Recent measurements show that the recombination coefficient α in the E-layer during aurorae is about 10^{-7}cm^{3}sec^{-1}, independent of the electron density, compared with the normal daytime value of about 2×10^{-8}. Tentative calculations show that the value of the negative ion/electron ratio during aurorae may be large enough to account for the greater value of α.

G.M.Brown

551.510.535

945. THE INTERPRETATION OF MEASUREMENTS OF RADIO-WAVE INTERACTION. L.G.H.Huxley.
J. atmos. terrest. Phys., Vol. 8, No. 1-2, 118-20 (Feb., 1956).

Re-examination of the theory of the interaction of radio-waves in the ionosphere shows that the physical quantity that is immediately concerned is the electron density n rather than the collisional frequency of the electrons. Tentative estimates, based on limited laboratory studies, indicate values of n in the range $(1.2\text{-}3) \times 10^{14}$ cm^{-3} for the height range 83-89 km.

G.M.Brown

551.510.535

946. ON THE OBSERVATION OF IONOSPHERIC SELF-INTERACTION. F.H.Hibberd.
J. atmos. terrest. Phys., Vol. 8, No. 1-2, 120-2 (Feb., 1956).

Discussion of precautions which must be taken in experi-

ments to observe and study ionospheric self-interaction. It is essential that only the once-reflected sky-wave is present to avoid interference between rays. An example is given of a test in which erroneous results could have been obtained. Due allowance must also be made for the finite band-width of the receiver and the shape of its selectivity curve. G.M.Brown

551.510.535

947. A POSSIBLE EXPLANATION OF THE DROP IN F-REGION CRITICAL DENSITIES ACCOMPANYING MAJOR IONOSPHERIC STORMS. M.J.Seaton.
J. atmos. terrest. Phys., Vol. 8, No. 1-2, 122-4 (Feb., 1956).

Explanation of the effect in terms of thermal expansion of the atmosphere is inadequate to account for both the increase in virtual height and decrease of electron density of the F-region during major ionospheric storms. An alternative explanation in terms of increased recombination coefficients is suggested. G.M.Brown

551.510.535

948. ELECTRON DISTRIBUTION IN THE IONOSPHERE. G.A.M.King.
J. atmos. terrest. Phys., Vol. 8, No. 3, 184-5 (March, 1956).

Additional note to author's previous paper (Abstr. 650/1955), concerned with the reduction of virtual height/frequency records, so as to include the effect of the earth's magnetic field. G.M.Brown

551.510.535

949. SOME UNUSUAL RADIO OBSERVATIONS MADE ON 23 FEBRUARY 1956. J.S.Belrose, M.H.Devenport and K.Weekes.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 281-6 (May, 1956).

All records of sky-wave signals showed clearly the effects of the solar disturbance at 0345 U.T. On 70-300 kc/s, a very strong absorption was noted which decreased after 0420. On 16 kc/s, a decrease of reflection-height of between 7 and 8 km occurred, with little change of amplitude. Conditions remained abnormal throughout daylight hours, but recovered during the ensuing night. D.R.Barber

551.510.535

950. A LONG-WAVE ANOMALY ASSOCIATED WITH THE ARRIVAL OF COSMIC-RAY PARTICLES OF SOLAR ORIGIN ON 23 FEBRUARY 1956. M.A.Ellison and J.H.Reid.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 291-3 (May, 1956).

A sudden decrease in received signal-strength on 24 kc/s was recorded at Edinburgh, the onset coinciding in time (0345 U.T.) with the arrival of the solar cosmic-ray particles in the dark terrestrial hemisphere. The result was to produce an "artificial sunrise" effect for D-layer reflections that corresponded to a drop of 10-15 km in the reflection-height. The time-interval (cosmic-ray max. minus solar flare max.) was about 0.3 hr, i.e. shorter than any of the four previously-recorded examples of a similar nature. D.R.Barber

551.510.535 : 551.501.8

951. A NOTE ON THE INTERPRETATION OF TRANSIENT ECHOES FROM THE IONOSPHERE. A.C.B.Lovell.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 293-4 (May, 1956).

Radio-echo meteor surveys on 70 Mc/s at Jodrell Bank show that the rate of occurrence of meteors often exhibits a pronounced mid-day maximum associated with the asymmetric distribution of meteoric matter around the earth's orbit. These maxima are real, independent of the effect of cosmic noise on apparatus sensitivity (contrast Shain and Kerr, Abstr. 10117/1955, who used a lower frequency of 18 Mc/s). G.M.Brown

551.510.535

952. AUTOMATIC RECORDING OF IONOSPHERIC CHARACTERISTICS. K.Bibl.
J. atmos. terrest. Phys., Vol. 8, No. 4-5, 295 (May, 1956).

Note on a device whereby a direct record of the MUF may be obtained on a c.r. tube from a conventional ionosonde, provided the frequency variation of the latter is logarithmic. G.M.Brown

551.510.535

953. CHANGES IN THE ABSORPTION OF COSMIC NOISE OBSERVED DURING TWO IONOSPHERIC DISTURBANCES. C.A.Shain.
J. atmos. terrest. Phys., Vol. 7, No. 6, 347-8 (Dec., 1955).

Observations of increased ionospheric absorption of 18.3 Mc/s cosmic noise at Hornsby on two dates in 1950 are shown to be associated with changes in the height of f_0F_2 as measured at Brisbane and Canberra. Delay-times enables the velocity of the ionospheric disturbance (~ 700 km/hr) to be measured. M.W.Ovenden

551.510.535

954. INTERPRETATION OF IONOSPHERIC MEASUREMENTS MADE DURING SOLAR ECLIPSES. C.M.Minnis.
Nature (London), Vol. 178, 33-4 (July 7, 1956).

The interpretation of E-layer measurements during solar eclipses, especially the estimation of the significance of any coronal contribution to the ionizing radiation, depends critically upon the assumed value of the recombination coefficient α. It is shown that a combination of observations of the same eclipse made at two or more stations enables α to be calculated. From the 1952 eclipse, observations at Khartoum and Ibadan together yield a value of 1.2 for α, implying an absence of any coronal contribution in this case. M.W.Ovenden.

551.510.535

955. REGIONS OF THE IONOSPHERE RESPONSIBLE FOR RADIO STAR SCINTILLATIONS. J.P.Wild and J.A.Roberts.
Nature (London), Vol. 178, 377-8 (Aug. 18, 1956).

Observations of the source Cygnus A at New South Wales suggest that night-time scintillations arise in the F-layer (strong correlation with the occurrence of spread-F echoes only) and day-time scintillations in the E-layer (significant correlation with sporadic E only). G.M.Brown

551.510.535

RADIO-WAVE PROPAGATION IN THE IONOSPHERE.
See also under "Electromagnetic waves and oscillations".
Decimal classification 538.566.3

551.521.1 : 535.345

956. INTEGRATED COEFFICIENT OF ABSORPTION OF SOLAR RADIATION BY SOME MATERIALS AND COATINGS. E.M.L'vova and G.S.Moroz.
Zh. tekh. Fiz., Vol. 26, No. 4, 850-2 (1956). In Russian.

Describes a comparator method and give results for several substances including silver (5%), zinc oxide (9.4%), aluminium foil (12.0%), copper foil (15.0%). J.M.Hough

551.574.1

957. PRODUCTION OF NUCLEI FROM AMMONIA AND NITRIC ACID. P.J.Nolan and E.Kuffel.
Geofis. pura appl., Vol. 31, No. 2, 50-3 (1955).

The size and charge distribution of nuclei obtained by passing air over ammonia and nitric acid are examined. In agreement with McHenry it was found that the average radius is less than 1.0×10^{-6} cm. The heterogeneity of the nuclei is discussed. A.

551.574.1

958. UNCHARGED CONDENSATION NUCLEI PRODUCED BY ULTRA-VIOLET LIGHT. J.R.Atkinson.
Geofis. pura appl., Vol. 31, No. 2, 54-9 (1955).

A large number of experiments have been carried out with the object of determining the nature, properties and source of the condensation nuclei produced by the action of a beam of ultraviolet light within an expansion chamber. This paper is essentially a qualitative summary of the results which have been obtained. It is concluded that these experiments show that it is the rubber component of the chambers that has been responsible for the major part of the effect. It is by no means suggested that this is the only source of the nuclei, but it is implied that only apparatus free from rubber should be used in any study of the properties of the nuclei associated with a given gas or vapour. A.

551.574.1

959. COAGULATION AND DIFFUSION OF ENCLOSED NUCLEI. P.J.Nolan and E.Kuffel.
Geofis. pura appl., Vol. 31, No. 2, 97-106 (1955).

Decay experiments were carried out with ultra-small nuclei, the sedimentation loss of which is negligible. It was found that the coefficient of the linear diffusion term in the decay equation varies as the square root of the diffusion coefficient. An interpretation of this relation, which takes convection into account, is suggested. Previous decay experiments are examined in the light of the new relation. A.

551.574.1

960. SOME CHARACTERISTICS OF CONDENSATION NUCLEI STORED IN A LARGE VESSEL. T.C.O'Connor. Geofis. pura appl., Vol. 31, No. 2, 107-14 (1955).

The coagulation coefficient, size and charge distribution of condensation nuclei from room air when stored in a 4000 litre rubber balloon gasometer were studied. The results indicate that the acquisition of water vapour contributes to the growth of stored nuclei. A preliminary trial was made to see if Junge's approximate rule that the number of particles in an aerosol varies inversely as the third power of their radius, also holds for Aitken nuclei. Further confirmation of the relationship between the percentage of stored nuclei electrically charged and their average radius was obtained. The measurements were carried out by means of the Pollak—Murphy improved version of the photoelectric nucleus counter. A statistical analysis based on over a thousand comparisons of two identical models shows that the agreement of individual readings is better than 10% of nucleus concentration in 80% of all cases. Excessive differences have now been eliminated. A.

551.593.55 : 535.331

961. CA II EMISSION LINES IN THE TWILIGHT SPECTRUM. A.V.Jones.
Nature (London), Vol. 178, 276-7 (Aug. 4, 1956).

For the first time, the H and K emission lines of Ca II have been identified in the twilight spectrum on spectrograms taken with a Schmidt spectrograph (dispersion, 20A/mm) at Saskatoon during the summer of 1955. The measured intensity ratio, 2.1 ± 0.5 is consistent with resonance excitation. The observed emission-height, 100-120 km, and the striking correlation of the dates of intermittent appearance of the lines with those of two major summer meteor showers, suggest that the Ca is of meteoric origin. D.R.Barber

551.593.9

962. ON THE EXTINCTION CORRECTION USED IN THE DETERMINATION OF AIRGLOW EMISSION HEIGHTS BY THE VAN RHIJN METHOD. M.J.Seaton.
J. atmos. terrest. Phys., Vol. 8, No. 1-2, 115-16 (Feb., 1956).

When determining airglow heights by van Rhijn's method a maximum correction to the zenith—horizon intensity-ratio may be expected for extinction by pure absorption, and cases of pure scatter may be met with for which the above correction is negligible. D.R.Barber

551.594.11

963. SHORT-PERIOD VARIATIONS IN THE ATMOSPHERIC ELECTRIC POTENTIAL GRADIENT. W.S.Whitlock and J.A.Chalmers.
Quart. J. Roy. Meteorol. Soc., Vol. 82, 325-36 (July, 1956).

Measurements made with 2 field mills, 100 m apart, along the direction of the surface wind, have been used to obtain information about the charges responsible for variations in the potential gradient over periods of the order of minutes. In general these variations are caused by the horizontal motion of wind-borne space charge contained within the first few hundred metres of atmosphere. In fair weather, there are effects probably caused by locomotive steam, and others perhaps to be associated with convection cells. In overcast weather there is evidence for concentrations of negative charge in the base of the thicker portions of the cloud. In showers, the main result is that the pattern of the potential gradient is very much affected by space charges from point discharge. A.

551.594.14

964. RADIOACTIVITY OF THE AIR AND PRECIPITATIONS. H.Garrigue.
C.R. Acad. Sci. (Paris), Vol. 243, No. 6, 584-5 (Aug. 6, 1956). In French.

Further results at the summit of Puy-de-Dôme for period May-July 1956 show presence of artificial radioactivity after 31st May 1956. J.M.Hough

551.594.14

965. A MEASUREMENT OF ATMOSPHERIC RADIOACTIVITY AT WELLINGTON. L.B.Crosthwait.
New Zealand J. Sci. Technol. B, Vol. 37, No. 3, 382-4 (Nov., 1955).

A filter paper method of collecting atmospheric radioactivity is described. The mean radon concentration found by this method was 34×10^{-18} curies per cm^3. A.

551.594.14

966. AN INVESTIGATION OF THE VARIATION OF THE ATMOSPHERIC RADIOACTIVITY AT WELLINGTON FROM 5 MAY TO 18 JULY 1955. N.G.Chapman and R.W.Humphrey.
New Zealand J. Sci.Technol. B, Vol. 37, No. 3, 396-406 (Nov., 1955).

The collection apparatus was situated 9 m above the local ground level and 130 m above sea level. The filter paper collection method was used, a description of the apparatus used and a discussion of the efficiency of this method being included. In this discussion a lower limit for the average value of the radon content in the period of 37×10^{-18} curies/cm^3 is obtained. A diurnal variation in the radon content was found which showed principal and secondary minima, the principal at about 12 to 14 hr N.Z.M.T. and the secondary at 20 to 21 hr N.Z.M.T. The effect of wind speed on the radioactive content is shown and some indications obtained regarding the influences of wind direction, barometric pressure, and rainfall. From the results, approximate upper limits for the amount of fission product activity present in relation to the amount of natural radioactivity in the atmosphere at this locality have been obtained. A.

551.594.21

967. ON THE PROBLEM OF THE ORIGIN OF THUNDERSTORM ELECTRICITY. D.Müller-Hillebrand.
Ark. Geofys., Vol. 2, Paper 18, 395-416 (1955). In German.

Measurements of thunderstorm electricity and the various theories proposed to account for its origin are briefly reviewed. An idealized picture of the charge distribution in a cloud is produced and the resulting distribution of field strength is evaluated. The distribution and movement of positive and negative ions and their effect on the charges carried by rain drops and other particles are examined for various stages of cloud growth. Following C.T.R.Wilson's original work, the principal cause of electrification is found to reside in influence phenomena occurring particularly in the collision of supercooled rain drops (graupel) with ice crystals. The increase in field strength is believed to be limited by corona discharges. Numerical estimates are shown to account for observational results. R.H.Golde

551.594.5

968. THEORY OF THE AURORAL SPECTRUM. D.R.Bates.
Ann. Géophys., Vol. 11, No. 3, 253-78 (July-Sept., 1955).

After summarizing the results of some recent work on collisions between heavy particles consideration is given to the emission of the Balmer lines of hydrogen, and to the possible emission of lines of other elements which may be present in the incident stream causing an aurora. The main luminescence observed is due to (i) inelastic collisions made by the incident particles and by the ejected electrons (which may posses kinetic energy other than that given them initially) (ii) degradation of the ultraviolet radiation emitted and, in the case of sunlit auroras, scattering of solar radiation (iii) thermal process such as dissociative recombination. These various mechanisms are discussed and estimates are made of the relative importance of some of them. Finally suggestions are advanced regarding the detailed reactions responsible for the excitation of the different lines and band systems. A.

551.594.5

969. AURORAL LUMINOSITY PRODUCED BY PROTONS FROM ANY DIRECTION. J.Morel-Viard.
C.R. Acad. Sci. (Paris), Vol. 243, No. 3, 292-5 (July 16, 1956). In French.

A pencil of protons of uniform velocity is considered entering the atmosphere and making any angle with the lines of force of the geomagnetic field. For each value of the entrance angle calculations are made of the relative luminosity for various altitudes. The curve of total luminosity is deduced. The results are shown graphically and compared with the curve when all protons follow the lines of magnetic force and the curve obtained for the emission H_α when using the effective sections given by Bates. It is concluded that at the moment of entry into the atmosphere the pencil of protons must show some dispersion about a mean speed and this would modify the curve of luminosity in a convenient way. R.S.Read

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578.087.73

970. APPARATUS FOR MEASURING HUMAN BODY VOLUME. W.E.Siri.
Rev. sci. Instrum., Vol. 27, No. 9, 729-38 (Sept., 1956).

A means for measuring the density or the volume of the whole body is essential to reliable estimates of fat in humans. Although Archimedes' principle has often been employed to determine density directly, a method that is less demanding on the subject has been developed for measuring body volume. The apparatus is a closed-circuit system consisting of two chambers and utilizing a gas-dilution principle. With the subject in one chamber and helium in the other, the gases in the system are mixed. The helium concentration, measured by thermal conductivity, is related to the tissue volume displacement of the subject. The standard deviation in volume determination is estimated as ± 0.12 litre. A.

578.087.8

971. A CONTRIBUTION TO THE STUDY OF THE PHOTOACTIVITY OF ANIMAL CELL TISSUE. J.Herzmann, J.Pospíšil and A.Setničková.
Czech. J. Phys., Vol. 6, No. 2, 192-3 (April, 1956). In German.

A short note on methods of examination of photoactivity of cell tissue by placing tissue in contact with photographic emulsion. The mechanism of the activity is briefly discussed. C.G.Morgan

MEDICAL SCIENCE. HUMAN PHYSIOLOGY 61

612-073

972. AN ELECTRONIC POSITION TIMER FOR THE FLUOROSCOPE. L.B.Lusted and E.R.Miller.
Radiology, Vol. 67, No. 2, 259-62 (Aug., 1956).

Optimum exposure time for spot-films during fluoroscopy can be determined from the thickness of the abdomen of the individual patient. On the basis of such determinations for various abdominal thicknesses, a spot-film exposure time scale has been constructed. An electronic timer which fixes the exposure time automatically in accordance with this scale has also been devised. Its construction and operation are described. A.

612.843.31

973. RECOGNITION OF LIGHT SIGNALS. P. L. Walraven.
Electrotechniek, Vol. 34, No. 15, 313-15 (July 26, 1956). In Dutch.

Tests for correct colour recognition using light sources at various brightness levels show that a threshold brightness exists where colour identification of red and green is no longer reliable, even in persons with normal colour perception. The Ishihara test in combination with the Edridge-Green lantern is described as a means of determining selection criteria from among both normal observers and colour defectives. G.du Cloux

612.843.612 : 621.396.96

974. DETECTION OF SEPARATIONS BETWEEN ADJACENT SIGNALS ON A SIMULATED P.P.I. RADAR SCOPE. R.M.Herrick, H.E.Adler, J.E.Coulson and G.L.Howett.
J. Opt. Soc. Amer., Vol. 46, No. 10, 861-6 (Oct., 1956)

A simulated Plan Position Indicator (P.P.I.) scope was used to evaluate the effects of a number of visual variables upon the minimum signal luminance increment (ΔI) required for the detection of a separation between two identical signals. The signal luminance increment is the difference between the signal luminance and the scope face luminance. All of the variables, viz., background luminance, distance between signals, scan rate, and simulated phosphorescence decay were of importance in determining threshold logΔI values. Moreover, most of the interactions among the variables were statistically significant. As the background luminance increases, an increase in logΔI is required for detection of a given separation. The background luminance is the most important determinant of the threshold logΔI. In general, for a given background luminance, the threshold logΔI must increase as the separation between signals decreases. The influence of simulated phosphorescence decay and scan rate upon logΔI thresholds is relatively small. A.

612.843.63

975. EFFECTS OF VIEWING DISTANCE WITH THE HOWARD-DOLMAN APPARATUS. W.H.Teichner and J.L.Kobrick.
J. Opt. Soc. Amer., Vol. 46, No. 10, 837-40 (Oct., 1956).

Studies of depth acuity under commonplace viewing conditions have not found the effects of viewing distance to be in accord with stereoscopic theory of depth perception. To account for the results, it was proposed previously that vernier acuity may be the major basis for the quantitative discrimination of real depth; that binocular parallax, although important to the impression of depth and critical for stereoscopic vision, may provide at best only a weak quantitative aid to real depth perception. Such an explanation might have been erroneously forced from the "commonplace" studies performed since in those studies all target edges were always clarly defined for the subject and this might be expected to enhance coincidence-type depth clues without necessarily enhancing the stereoscopic clue. On the other hand, in the standard Howard-Dolman two-rod test upon which the "commonplace" studies were modelled, only the vertical edges of the rods are visible, and this might be expected to enhance the relative utility of stereopsis as a depth clue by reducing the effectiveness of vernier-type depth clues. This experiment was designed primarily to investigate this matter by studying the effects of distance with the Howard-Dolman apparatus. It was found that a distance function derived earlier from the average acuities obtained in a "commonplace" study provided a very good fit to the average acuities obtained with the Howard-Dolman test. It was concluded, therefore, that the possible relative disadvantage of stereopsis as a clue in the "commonplace" studies did not affect the results obtained or vernier hypothesis proposed. A.

612.843.72

976. EFFECT OF VERTICAL MISALIGNMENT OF OPTICAL IMAGES ON DEPTH JUDGMENTS. G.S.Harker and A.C.Henderson.
J. Opt. Soc. Amer., Vol. 46, No. 10, 841-5 (Oct., 1956).

Sensitivity of the visual function to vertical misalignment in the making of depth judgments was demonstrated for values of vertical prism of 0.5 and 1 diopter when an observer alternated from "normal" viewing to viewing with vertical misalignment. The variables of exposure time and alternation rate were not shown to be significant. The failure to show an expected significance of alternation rate is attributed to the over-all variability of the data and insensitivity of the experimental design. The data are intergrated with those of Ogle on "Stereopsis and vertical disparity", and Ogle and Prangen on "Vertical divergence and hyperphoria". Compensatory movements of the eyes and the pressure to respond rapidly are felt to have removed the experimental task from the class of depth tasks studied by Ogle and also to account for the demonstrated sensitivity of the eye to vertical misalignment of the presented images in the making of depth judgments. A.

612.858

977. ONSET AND GROWTH OF AURAL HARMONICS IN THE OVERLOADED EAR. M.Lawrence and P.A.Yantis.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 852-8 (Sept., 1956).

The threshold of overload and the growth in intensity of the aural harmonics are determined by the exploring tone method for frequencies of 100, 350, 1000, 2000 and 5000 c/s. It is found that the level of a test tone at which it first overloads the ear can be quite accurately determined and that the range of beats between the second harmonic and the exploring tone, as the latter is changed in intensity, is considerably narrower at the overload threshold level than at higher levels. As the test tone is raised in intensity the loudness of the harmonic increases rapidly. Overloading occurs at approximately the same sound pressure level for all frequencies so that the

range of linear response is around 8 dB at 100 c/s, 30 dB at 350 c/s and 50 dB at 1000, 2000 and 5000 c/s. All harmonics are detected when they reach a certain consistent level above threshold for that frequency. The exact level depends upon the subject. These results are considered as additional evidence that distortion in the ear takes place within the sensory cells as part of the electromechanical process and is not due to any nonlinearity of the mechanical response of the ear. A.

612.858

978. SOME MEASUREMENTS OF INTERAURAL TIME DIFFERENCE THRESHOLDS. R.G.Klumpp and H.R.Eady.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 859-60 (Sept., 1956).

Thresholds for the detection of interaural time difference were determined by ten listeners (1) for band-limited random noise (150-1700 c/s), (2) for a 1000 c/s tone, and (3) for a 1 millisec click. The average interaural time differences corresponding to 75% correct detection in the symmetrical two-alternative tests were (1) 9 microsec, (2) 11 microsec, and (3) 28 microsec. Ranges of individual thresholds and group psychometric functions are presented. A.

612.858

979. JUST NOTICEABLE DIFFERENCES IN DICHOTIC PHASE. J.Zwislocki and R.S.Feldman.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 860-4 (Sept., 1956).

The just noticeable difference in dichotic phase, as a function of sensation level and of frequency, has been determined on a number of listeners with normal hearing. The test tones were transmitted by earphones, and the phase difference between the ears was varied by means of an electronic phase-shifter. The psycho-physical method used combined paired comparisons and forced choice. The first tone pulse of each pair presented was kept at a constant phase difference at which the subject localized the sound source as equidistant from his ears. The dichotic phase difference of the second pulse was varied irregularly ("randomly"). The results show that the sensitivity to dichotic phase difference is highest (2° of phase) at medium sensation levels, and that the j.n.d. increases with positive acceleration as the sound frequency increases. Around 1300 c/s the j.n.d. becomes so great that it cannot be measured. The dichotic time difference calculated from the measured j.n.d. in phase has a minimum near 800 c/s. A.

612.858.71

980. THEORY OF RECOGNITION. W.P.Tanner, Jr.
J. Acoust. Soc. Amer., Vol. 28, No. 8, 882-8 (Sept., 1956).

The theory of statistical decision has previously been applied to the problem of sensory detection of signals. In this paper, the theory is expanded to treat a simple recognition problem. While the data supporting the expansion have been collected in auditory experiments, the theory applies generally to all human sensory behaviour. A.

612.858.71

981. IDENTIFICATION AND DISCRIMINATION OF COMPONENTS OF ELEMENTARY AUDITORY DISPLAYS. I.Pollack.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 906-9 (Sept., 1956).

The absolute identification and differential discrimination of the sound level of tones were studied over a wide range of sound levels under comparable experimental conditions, and the results of the two experiments were compared in comparable units. Absolute identification improves and differential discrimination deteriorates as the range of sound levels examined increases. The net effect of these complementary changes is that the information associated with differential discrimination is roughly of the same magnitude as that associated with absolute identification. A.

612.858.74

982. NEUROLOGICAL THEORY OF BEAT TONES. M.F.Meyer.
J. Acoust. Soc. Amer., Vol. 28, No. 5, 877-81 (Sept., 1956).

Tartini pitches and beat tones behave differently and must have different physiological origins. Tartini pitches are heard only if the primary tones remain below 2000 c/s, preferably for clear observance below 1000. The cochlea is essential for hearing them. Beat tones are not so limited. Their observation is easiest (least confusing) when the primaries are chosen in the region from 3000 to 5000 c/s . But lower tones may be used (although there may then be an overlapping of Tartini pitches and beat tones). The cochlea need not exist for the existence of beat tones. A.

614.898

983. THE BASIS FOR STANDARDS FOR RADIATION PROTECTION. L.S.Taylor.
J.Washington Acad. Sci., Vol. 46, No. 3, 69-77 (March, 1956).

A full discussion of the radiation hazard to man is given. Formulating a standard for protection requires determination of the limits of exposure which the individual or population can receive without encountering risks incommensurate with the benefits to be expected from the use of radiation. The hazard varies with the half-life of the isotope and the susceptibility of and retention in the organs concerned. Ingestion with food and water is considered. Current values for permissible dosage levels are presented and references given.

D.V.Mabbs

615.849

984. THE INTRODUCTION OF THE RAD IN RADIOTHERAPY PRACTICE: A SYMPOSIUM.
I. RADIATION UNITS IN USE IN GREAT-BRITAIN. R.Paterson.
II. THE TRANSITION FROM RÖNTGEN TO RAD. L.H.Gray.
III. THE USE OF THE RAD IN CLINICAL DOSAGE. M.J.Day.
IV. CONVERSION OF RÖNTGENS TO RADS. F.Ellis.
Brit. J. Radiol., Vol. 29, 353-5, 355-8, 358-67, 367-9 (July, 1956).

Symposium given at the Annual Congress of the British Institute of Radiology, December 1955. The transition from an ionization unit (the roentgen) to an absorbed energy unit (the rad) is shown to involve not merely a conversion but a change to thinking in terms of a true radiation dose. The change is simplest for β-rays. For X-rays it will depend on the value of the energy to form an ion pair (W) the relative stopping power S and the absorption coefficients in the media concerned. Difficulty is still present in estimating dose absorbed in bone undergoing irradiation by 200 kV X-rays because of the added contribution from photoelectric absorption in the Ca, this causing several-fold dose variations in very small distances (50 μ). Routine recording of absorbed doses is not expected to be burdensome. Universally accepted values for W and S are essential. Before introducing the rad to clinical practice, comparisons have been made of calibrations of the dosemeters from various centres in England. Tables are given. A practical system for expressing routine clinical dosage in rads is outlined for 200 kV and for 4 MeV X-rays. Physical factors involved in the estimation of absorbed dose are discussed and curves are shown. Tables are given showing comparisons between energy absorption for different types of radiation in bone and soft tissue. Relationship between the rad and the roentgen for the former and the revised N.P.L. calibration is presented, and likely errors in estimating dosage and in intercomparison with other centres are assessed. D.V.Mabbs

615.849.1

985. RADIATION DOSE DISTRIBUTION IN WATER FOR 22.5-MeV-PEAK ROENTGEN RAYS. G.Shapiro, W.S.Ernst and J.Ovadia.
Radiology, Vol. 66, No. 3, 429-37 (March, 1956).

The dose distribution in water produced by an X-ray beam from a 22.5 MeV betatron has been examined with an automatic isodose plotting device. The collimation system and compensating filter are described. Central axis depth doses and some isodose distributions are given for three different target surface distances. Illustrations of isodose distributions for obliquely incident fields are included. H.Miller

TECHNIQUE. MATERIALS 62/69

621.95

986. SPECIAL METHOD FOR BORING VERY FINE ROUND HOLES. S.Shinozuka.
Rev. sci. Instrum., Vol. 27, No. 7, 542-3 (July, 1956).

Full details are given for boring round, straight apertures in metal sheeting. They are 20-100 μ in diameter and hence suitable for electron-optical purposes. R.Reed

66.06

987. THYRATRON-CONTROLLED STIRRER OR PUMP FOR PRESSURIZED SYSTEMS. L.W.Brandt and W.M.Deaton.
Rev. sci. Instrum., Vol. 27, No. 9, 714-15 (Sept., 1956).

An apparatus is described which provides a simple means of obtaining stirring or pumping action in a pressurized system. Since no packing glands are employed, the device is leak-proof. The required mechanical action is provided by reciprocating motion of a soft-iron armature enclosed in the system and driven by a pair of electromagnetic coils. Input to the coils is provided by a thyratron-controlled circuit. The circuit and constructional details are given. A.

669

988. ON THE PREPARATION AND REGENERATION OF CLEAN GERMANIUM SURFACES. P.H.Robinson, A.J.Rosenberg and H.C.Gatos.
J. appl. Phys., Vol. 27, No. 8, 962 (Aug., 1956).

Such surfaces prepared by the Farnsworth (Abstr. 4993/1955) technique show electrical properties markedly affected by oxygen. This effect has been studied on surfaces prepared by cleavage in vacuum. It appears that Ge crystals grown in graphite crucibles contain CO and that this dissolved gas is relatively mobile above 250° C. This fact is used to explain the partial regeneration of oxygenated Ge surfaces by heat treatment. Further work is promised. W.Bardsley

669

989. APPARATUS FOR PREPARING METAL POWDERS UNDER PROTECTIVE ATMOSPHERES. H.L.Nurnberg, R.F.Domagala and D.W.Levinson.
Rev. sci. Instrum., Vol. 27, No. 9, 728-9 (Sept., 1956).

The unit is simply a hermetically sealed chamber which is provided with a drive mechanism at the top, specimen and sight ports at the sides, and a funnel at the bottom. The drive mechanism is used to rapidly rotate a rotary cutter. Particles of any desired size are produced by a suitable choice of cutter and screen. A.

669.04

990. ZONE MELTING OF URANIUM. J.E.Antill, E.Barnes and M.Gardner.
Atomic Energy Res. Establ. (Harwell) Rep. No. M/R 1985, 10 pp. (1956).

Zone melting experiments in a vertical furnace have shown that to remove soluble metallic elements from uranium slow zone speeds ($\frac{1}{4}$ in/hr) are necessary. Density differences may be harnessed to increase the purification. The non-metallic elements carbon and oxygen may be removed at much faster zone speeds (3 in/hr). Zone melting has been considered as a modified self-slagging process for the removal of fission products from irradiated uranium. Greater decontaminations for zirconium and for total γ-activity were obtained than in self-slagging experiments. A certain minimum concentration of carbon and oxygen is necessary to obtain the maximum decontamination of fission products. A.

681.42 : 535.417

INTERFERENCE METHOD FOR SPHERICAL LENS SURFACE TESTING. See Abstr. 293

PHOTOGRAPHY 77

77.023 : 537.531.08 : 539.166.08

991. STABILIZATION FILM PROCESSING FOR X- AND γ-RAY DOSIMETRY. S.Levinos and M.Ehrlich.
Nucleonics, Vol. 14, No. 7, 72-4 (July, 1956).

A diaminophenol hydrochloride developer plus thiourea is used in conjunction with a hardening bath and a thiourea stabilizer. The stabilizer converts the undeveloped silver salts into a transparent insoluble compound and gives a rapid processing method using little water. The coverage of fast dosimeter film is extended to 30 000 r and the method should be of value for field work. Full details of the process and some characteristic curves for dosimeter film are given.

R.D.Smith

771.534.55

992. STUDY OF THE SPATIAL FREQUENCY SPECTRUM IN PHOTOGRAPHIC NEGATIVES. P.Croce and M.Marquet.
Optica Acta, Vol. 3, No. 2, 94 (June, 1956). In French.

When applying information theory to photography, it is necessary to know the frequency spectrum of the photographic emulsion and the noise introduced by it. Measurements are reported on three negatives, one with a normal exposure, a second with a double exposure with a small translation between exposures, and a third with a great deal of movement during the exposure. R.W.Fish

771.534.554 : 519.2

993. AUTOCORRELATION AND GRANULARITY. I. THEORY. H.J.Zweig.
J. Opt. Soc. Amer., Vol. 46, No. 10, 805-11 (Oct., 1956).

The applicability of time-series analysis to microphotometer traces is developed with particular reference to two proposed measures of photographic granularity. It is shown that two equivalent functions may be obtained from a microphotometer trace — a correlogram and a power spectrum — and that both Selwyn's measure of granularity depending on density dispersion σ_D, as well as Jones and Higgin's measure depending on syzygetic density difference $\langle S\Delta D\rangle_{Av}$, are directly related to these functions. The conditions under which these measures are equivalent are pointed out. A.

771.534.554 : 519.2

994. AUTOCORRELATION AND GRANULARITY. II. RESULTS ON FLASHED BLACK-AND-WHITE EMULSIONS. H.J.Zweig.
J. Opt. Soc. Amer., Vol. 40, No. 10, 812-20 (Oct., 1956).

The relation of Selwyn's granularity measure to the character of the autocorrelation function and the granularity spectrum is discussed. The shape of the autocorrelation function as experimentally obtained leads to the conclusion that Selwyn's granularity function $\sigma_D.d$ should be essentially constant and independent of d. The fact that it is found to increase with d can be explained by (a) the existence of macroscopic variation in density (which can be largely eliminated) and (b) a combination of finite grain size and imperfect imagery. Jones and Higgin's data on the perception of graininess are combined with the present data on granularity to provide a measure of granularity for uniformly flashed black-and-white emulsions, which is approximately independent of the area of the scanning spot and the density of the sample. A.

771.534.56 : 537.531.08

RECIPROCITY LAW FOR X-RAYS. See Abstr. 443-4

LIST OF JOURNALS

The following list supplements the Lists of Journals published with the January number of Volume 56 (1953) and the Supplements published with the Indexes to Volumes 56 (1953), 57 (1954), 58 (1955) and 59 (1956). Copies of the numbers containing these lists can be obtained from The Instituion of Electrical Engineers, Savoy Place, London, W.C.2.

The addresses given are believed to be correct at the date of publication, but no responsibility can be accepted for errors.

nn. Univ. Ferrara Sez. VII	Annali dell'Università di Ferrara. Sezione VII. Scienze Matematiche. (Abstracted by Mathematical Reviews).
tomnaya energiya	Atomnaya energiya. Akademiya Nauk SSSR, Cherkasskiĭ per., 2, Moscow. [An English translation is published as Part II of The Journal of Nuclear Energy].
ul. Inst. Politeh. Iaşi	Buletinul Institutului Politehnic din Iaşi. Serie Nouă. Mathematical Institute, Polytechnical Institute, Jassy. Formerly referenced under French title: Bulletin de l'Institut Polytechnique de Jassy [Bull. Inst. Polyt. Jassy].
ull. Internat. Acad. Yougoslave, Cl. Sci. Math. Phys. Tech.	Bulletin International de l'Académie Yougoslave des Sciences et des Beaux-Arts. Classe des Sciences Mathématiques, Physiques et Techniques. (Abstracted by Mathematical Reviews).
EG Ber.	CEG Berichte. Berichte der Continental-Elektroindustrie. Jacobistrasse 3-5, Düsseldorf.
lectronic Radio Engr	Electronic and Radio Engineer. Formerly Wireless Engineer [Wireless Engr].
xper. Tech. Phys.	Experimentelle Technik der Physik Oberwasserstrasse 11/12, Berlin, C.2.
SA J.	ISA Journal. Instrument Society of America. Granite Building, 313 Sixth Avenue, Pittsburgh 22, Philadelphia. Formerly contained in: Instruments (now: Instruments and Automation).
achrichtentech. Fachber. [NTF]	Nachrichtentechnische Fachberichte [NTF]. Beihefte der NTZ. F.Vieweg & Sohn, Postfach 185, Brunswick.
hilips Telecomm. Rev.	Philips Telecommunications Review. Formerly: Communication News [Commun. News]. Philips' Gloeilampenfabrieken, Eindhoven.

NEW JOURNALS

cta electronica	Acta Electronica. 23 Rue du Retrait, Paris XX^{e}. Quarterly. Vol. 1, No. 1 dated Jan., 1956.
n. Inst. Fís.	Anales del Instituto de Física. Universidad Nacional Autonoma de Mexico, Apartado Postal No. 31364, Mexico 20, D.F. Vol. 1 dated 1955.
. Technol. [Calcutta].	Journal of Technology. Publishers: Bengal Engineering College, P.O. Botanic Garden, Howrah, India. Obtainable from: The Superintendent, West Bengal Government Press, Calcutta, India. Half-yearly. Vol. 1, No. 1 dated June, 1956.
. Danske Vidensk. Selsk. Mat.-fys. Skr.	Kongelige Danske Videnskabernes Selskab Matematisk-fysiske Skrifter. Dantes plads 5, Copenhagen V. Vol. 1, No. 1 dated 1956.
oint to Point Telecomm.	Point to Point Telecommunications. Communications Division, Marconi's Wireless Telegraph Company, Marconi House, Chelmsford. Vol. 1, No. 1 dated Oct., 1956.

NOTES

cta polytech.	Acta polytechnica. Commencing with No. 194 (1956) a new Series will be published: Applied Mathematics and Computing Machinery. Commencing with No. 177 (1955) the series now known as "Physics and Applied Mathematics" changed to "Physics including Nucleonics".
ommun. News	Communication News. Title changed to: Philips Telecommunication Review [Philips Telecomm. Rev.] starting with Vol. 17, No. 1 (Aug., 1956).
ullard tech. Commun.	Mullard Technical Communications. Address changed to: Mullard House, Torrington Place, London, W.C.1.
roc. Instn Civil Engrs	Proceedings of the Institution of Civil Engineers. As from January 1957 the issue of the Proceedings in three parts will be discontinued. Thereafter, publication will be in one part, issued monthly.
ireless Engr	Wireless Engineer. Title changed to: Electronic and Radio Engineer [Electronic Radio Engr] starting with Vol. 34, No. 1, Jan., 1957.

ERRATA

Abstr. 324 (1956) line 3 : for "S.Sieskind" read "M.Sieskind".
Abstr. 2446 (1956) line 5 : insert "μ" at beginning of line.
Abstr. 2707 (1956) line 3 : for "THR" read "THE".
Abstr. 4323 (1956) line 2 : for "P-FLUORCHLORO" read "P-FLUOROCHLORO".
Abstr. 4450 (1956) line 2 : for "Shulman" read "Shul'man".
Abstr. 4626 (1956) line 2 : insert "γ".
4 : the second author's name is "Armbruster".
Abstr. 4635 (1956) line 3 : for "Zucker" read "A.Zucker".
Abstr. 5015 (1956) line 2 : for "EXITATION" read "EXCITATION".
Abstr. 5683 (1956) line 6 : for "Abstr. 4808 (1956)" read "Abstr. 4802 (1956)".
Abstr. 5714 (1956) line 2 : for "V.Grossmann-Doerth" read "U.Grossmann-Doerth".
Abstr. 6227 (1956) line 2 : for "ISOBAR" read "ISOBARS".
Author Index (1956) p. 1020, column 2 : insert entry "Balasse, G. and Lemmens, M.L. Heterochromatic photometry of continuous spectra : contribution towards the provision of a neutral standardizing method for photographic plates, 8086".
p. 1043, column 2 : under Ditchburn, R.W. delete entry "Optical instruments for the vacuum ultraviolet, 8086".
p. 1066, column 1 : under Hornig, D.F. delete entry "See also Wray, K.L., 7574".
p. 1082, column 1 : insert entry "Lemmens, M.L. See Balasse, G., 8086".
p. 1140, column 1 : delete entry "Wray, K.L. and Hornig, D.F. Dissociation energy of fluorine, 7574".
p. 1140, column 1 : Wu, T.T., the abstract number is "8877".
Subject Index (1956) p. 1212, column 2 : under "Molecules, dissociation energies", entry "F_2", delete "7574".
p. 1248, column 2 : under "Shock waves" delete entry "dissociation energy det. of F_2 7574".

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